The Builder.

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IN a maritime country like England, the construction of LIGHT-HOUSES is a subject of great importance, and it becomes of the utmost consequence that the details of such works should be carefully recorded, including the relation of failures as well as successes, and when completed, that they should be made public to the utmost possible extent. So, indeed, it should be with all great works of the architect and engineer,—important buildings, public and private, railways, bridges, docks, &c.,—so as to facilitate to the utmost the progress towards perfection. The disinclination towards this publication on the part of contemporaries, of architects even more than of engineers, is much to be regretted, and in many cases reprobated. Such books, it is true, are costly, and the certainty of a return not always clear; but it is not this which usually weighs, as has been proved again and again. Still we would have even the pretext removed in the case of really important works, by the certainty of receiving such aid from public bodies as would lessen the risk and encourage the attempt. What is for national service might justly expect to receive national aid. The requirement of a number of copies for certain public libraries is a heavy and most unjust tax on the producers of costly books, and ought to have been abolished long ago,—the books being of course still deposited, but paid for out of funds provided for that purpose.

Regarding the publication of ample details of structural works as of this great importance, then, and regretting that they are seldom given to us, our praises are eminently due to those who, not afraid of "making others as wise as themselves," or of affording grounds for criticism, furnish information of this character. Amongst these we will place Mr. Alan Stevenson, whose "Account of the Skerryvore Lighthouse; with Notes on the Illumination of Lighthouses," has been before us for some little time, and has afforded us much gratification and instruction.* Before endeavouring to give our readers a general notion of the contents of this volume,—a large quarto, containing 440 pages and 33 plates,—let us remark, that in our last volume will be found a valuable account of the construction of the lighthouse recently erected at the port of Havana,† and in the present volume a brief notice of the history of lighthouses.‡ Their early history is very obscure, though allusions to the subject of beacon-lights are to be found in many ancient writings. The celebrated Colossus of Rhodes, constructed about 300 years before our era, was probably a lighthouse. The Pharos of Alexandria, built about the same time, was regarded as one of the wonders of the ancient world. Strabo, who describes it, gives the impression that it must have been of immense size: he says *Sostratus* was the architect, and Pliny states that it cost a sum equal to either 390,000*l.* of our money, or 195,000*l.*, probably the former, but depending upon whether he was speaking of the Egyptian talent or the Attic talent. Mr. Stevenson gives some curious particulars of this structure. Lucian, in his art of writing history, accuses Sostratus of a fraud, in cutting his own name on the solid wall of the tower, and covering the inscription with plaster on which he carved the name of his royal master, Ptolemy. Pliny, on the contrary, expressly states, as a proof of Ptolemy's magnanimity, that he gave the architect liberty to inscribe his own name. Enough, however, of this, simply adding the note, that the Latin words *turris* and *columna* have been supposed, primarily, to signify a lighthouse, the first being written *tor-is*, the tower of fire; and the *col-on*, the pillar of the sun!

The most important lighthouse, in point of architectural splendour, is the *Tour de Corduan*, on the coast of France, commenced in 1584, but not finished till 1610. *Belidor* describes it fully in the "Architecture Hydraulique." It stands upon a solid mass of masonry, consists of four stories 169 feet high, and displays pilasters, entablatures, pinnacles, dormers, and stone dome. The lowest story is Doric, the second Ionic, the third Corinthian, and the lantern Composite. Some of the interior apartments are very fine, and exhibit paintings and mosaics.*

Our famous Eddystone Lighthouse is well known from Smeaton's own valuable and interesting narrative,† as is also the second in importance, the Bell Rock Lighthouse, from the account of its architect, Mr. Robert Stevenson, father of the gentleman whose work is before us, and to which we now again turn.

Neither of these which we have last-named are so lofty as the Skerryvore Tower, which we should say is situated near the island of Tyree and the island of Iona.

The first stone was formally laid on the 7th of July, 1840, and the last in August, 1842, although the operations were commenced in 1838, and the men were on the rock six seasons. Only those who know the difficulties and dangers of such works will sufficiently appreciate the fact that, during the whole of that time, there was no loss of either life or limb. "Those who best know the nature of the service in which we were engaged," says our author, "the daily jeopardy connected with landing weighty materials in a heavy surf and transporting the workmen in boats through a boisterous sea, the risks to so many men, involved in mining the foundations of the Tower in a space so limited, and above all, the destruction, in a single night, by the violence of the waves, of our temporary barrack on the rock, which had cost the toils of a whole season, will not wonder that I am anxious to express,—what I know to have been a general feeling amongst those engaged in the work, that of—heartfelt thankfulness to Almighty God for merciful preservation in danger, and for the final success which terminated our arduous and protracted labours."

The barrack which they first erected on the rock, for the protection of the workmen, was washed away, as above noted, in a night; but, with this exception, they appear to have gone on from the commencement to the end, steadily preparing for any coming difficulties, and always successfully meeting them.

The third chapter of the work treats of the construction of lighthouse towers generally, and involves two considerations:—1. Those which refer to elements common to lighthouses in all situations, and differ only in amount,—such as the height of the tower necessary for commanding a given visible horizon, and the accommodation required for keepers and stores; and, 2nd, those which are peculiar to towers in exposed situations, and refer solely to their fitness to resist the force of the waves, which tend to destroy them. Under the second head our author remarks, that we know little of the nature, amount, and modification of the forces, on the proper investigation of which the application of the principle which regulates the construction must be based. There have been few experiments to measure the force of the waves: we cannot be said to possess the elements of exact investigation, and must, consequently, be guided chiefly by "the result of those numerous cases which observation collects and which reason arranges, in the form which constitutes what is called *professional experience*." Our author remarks:—

"We must not, however, in any case, venture to approach too near the limit of stability, so long as we continue to labour under our present disadvantages of defective information on some of the most important elements in the inquiry. If it be asked, therefore, how the size and form of buildings exposed to the shock of the waves are to be determined, the answer must be, that, in any given case, the problem is to be solved chiefly by the union of an extensive knowledge of what the sea has done against man, and how, and to what extent, man has succeeded in controlling the sea; together with a cautious comparison of the circumstances which modify and affect any given case which has not been the object of direct experience; nor does it seem possible as yet to found the art of engineering, in so far as it refers to this class of works, upon any more exact basis. The uncertainty which must ever attend such reasoning can only, it is obvious, be dispelled by actual experience of the result; and time only can test the success of our schemes in cases of difficulty.

A primary inquiry, in regard to towers in an exposed situation, is the question, whether their stability should depend upon their strength or their weight; or, in other words, on their cohesion, or their inertia? In prefering weight to strength, we more closely follow the course pointed out by the analogy of nature; and this must not be regarded as a mere notional advantage, for the more close the analogy between nature and our works, the less difficulty we shall experience in passing from nature to art, and the more directly will our observations on natural phenomena bear upon the artificial project."

In respect of form, he says:—

"The sum of our knowledge appears to be contained in this proposition—That, as the stability of a sea-tower depends, *cæteris paribus*, on the lowness of its centre of gravity, the general notion of its form is that of a cone; but that, as the forces to which its several horizontal sections are opposed decrease towards its top in a rapid ratio, the solid should be generated by the revolution of some curve line convex to the axis of the tower, and gradually approaching to parallelism with it. And this is, in fact, a general description of the Eddystone Tower devised by Smeaton."

Our author's inquiry into the best form to be adopted is interesting, but we have not space to follow him in it: suffice it to say, that the outline of the Skerryvore column is generated by the revolution of a rectangular hyperbola about its assymptote as a vertical axis. The whole height is 138½ feet; its diameter, at the base, 42 feet; and at the top 16 feet.

"The first 26 feet of height is a solid frustrum, containing about 27,110 cubic feet, and weighing about 1,990 tons.* Immediately

* "Account of the Skerryvore Lighthouse; with Notes on the Illumination of Lighthouses. By Alan Stevenson, LL.B., &c. By order of the Commissioners of Northern Lighthouses." Adam Black and Co., Edinburgh; Longman and Co., London. 1848.

† See Vol. V., p. 527.

‡ See p. 33, *ante*.

* Mr. Cresy, in his "Encyclopædia of Civil Engineering," gives some particulars, and several engraved illustrations, of this structure.

† Condensed by Cresy, in his "Encyclopædia."

* At the rate of 13.62 cubic feet of granite to a ton.

above this level the walls are 9.58 feet thick, whence they gradually decrease throughout the whole height of the shaft, until at the belt they are reduced to 2 feet in thickness. Above the shaft rests a cylindric belt 18 inches deep; and this is surmounted by a cavetto 6 feet high, and having 3 feet of projection. The contour of this cavetto is that resulting from a quadrant of an ellipse revolving about the centre of the tower, with a radius of 8 feet on the level of its transverse axis; and the moulds for this curve were drawn at full size from co-ordinates calculated for the purpose. The cavetto supports an abacus 3 feet deep, the upper surface of which forms the balcony of the tower, and above it rest the parapet-wall and lantern."

In the Eddystone and Bell Rock lighthouses the stones were dovetailed throughout the building. In the upper part of the Bell Rock a kind of band joggle was introduced, which consisted of a flat riband of stone raised upon the upper bed of one course, and fitting in to a corresponding groove cut into the under bed of the course above. Mr. Stevenson says—

"In the lower parts of the Skerryvore Tower, I entirely dispensed with dovetailing and joggles between the courses, and thus avoided much expensive dressing of materials. The stones were retained in their places during the early progress of the work, chiefly by common diamond joggles, and the courses were temporarily united to each other by wooden treenails, like those used in the Eddystone and Bell Rock. These treenails had split ends, with small wedges of hardwood loosely inserted, which, being forced against the bottom of the holes in the course below, into which the treenails were driven, expanded their lower ends until they pressed against the sides of the holes; while their tops were made tight by similar wedges driven into them with a mallet. I have, however, adopted the ribband-joggle in the higher part of the tower, where the walls begin to get thin in the very same manner as at the Bell Rock, where it was used, partly that it might counteract any tendency to a spreading outwards of the stones, and partly that it might operate as a kind of false joint to exclude the water which, when pressed with great violence against the Tower, is apt to be forced through a straight or plain joint. The stones in the higher courses throughout each ring are also connected at the ends by double dovetailed joggles, which unite the two adjoining stones; and the walls are, besides, tied together at various points by means of the floor stones, which are all connected by dovetails let into large circular stones which form the centres of the floors."

The operations of each year are given in detail, a chapter being appropriated to each. The granite was from the quarry of the Ross of Mull. The freight usually paid was 5s. a ton, and yet the whole of the blocks for the lighthouse tower were laid down at the rate of 2s. 1½d. per cubic foot, including all the expense of building barracks, opening quarries, freight of stones, and the expense of building and maintaining a vessel. Some particulars are given of quarrying granite.

All the materials required for the tower were dressed in such a manner as to avoid any fitting on the rock, and the greatest accuracy was therefore required in the formation of the mould from which the stones were shaped. A *trainer*, or radius, was made with a moveable vernier, capable of sliding along it, so as to give the differences between the readings of the feet as far as to the thirtieth part of an inch, and the architect was thus enabled to lay off the batter or slope on each course, according to a table of co-ordinates, with great nicety, and so as to trace very distinctly the contour of the intended column. Such nicety, as the author observes, "was by no means superfluous, because the arrangements of the tower precluded the possibility of using a trainer in building; and as the whole was done by means of *plumb-templets*, the greatest accuracy in tracing the curve of the tower became necessary, as the only true basis of good workmanship on the rock." The masonry of the tower contains 58,580 cubic feet, or about 4,308 tons.* The mortar used was composed of equal parts of Aberdda lime and Pozzolano earth.

We congratulate Mr. Alan Stevenson and the country on the successful completion of an arduous and important undertaking, and thank him much for his clear and interesting account of it.

REMARKS ON "ARCHITECTURAL MAXIMS AND THEOREMS."†

CONSTRUCTION.

"It will be perceived," says Mr. Donaldson in his preface, "that the subject has been divided into two parts — the art and the science; or, if it may be said with the schoolmen, into the metaphysics and physics of architecture: the one comprehending the abstract principles of taste in the combination of masses or substances, and the reason and understanding of the causes of certain emotions produced by them in the mind; the other treating on the qualities inherent in matter, and the proper application and combination of such materials in reference to construction."—(p. viii.) The discussion of that part of the work treating of architecture the fine-art I completed in my former paper; and I promised in the present continuation to take up the part treating of architecture the science —or what I would rather call constructive housebuilding, and the lecture on the practice, the "walk and conversation" (as the old writers would have said) of the architect.

Of course we were not to look for, in the sixty "maxims" under the head *construction*, anything approximating or pretending to a system of constructive science; all that appears to have been aimed at is simply the jotting down of a few valuable hints, axioms, facts,—a few pages contributed to the architect's stock of scientific knowledge.

These maxims, however, are systematically arranged according to the several departments into which the subject is divisible; and, so far as they go, there is a completeness about them, constituted by your having laid before you, with respect to every branch, some few notable points. But I rise from the perusal of them with disappointment: not that I can blame them for a deficiency which arises only from their fewness,—sure enough they pretend to be no more than "in elucidation of *some* of the principles" of the subject; but the disappointment is none the less keen which springs from their suggestion of the fact of how lamentably deficient our system of constructive science is altogether and at its best. Constructive science is a subject so complex, copious, diffusive,—a subject so very inadequately represented in the library,—withal a subject so very little really rationally, practically, known as it ought to be, that the great magnitude of the theme and the great need for the treatise together make these sixty maxims of Mr. Donaldson's only a sort of sixty crumbs to a hungry man. Very good crumbs they may be, and frequently of substance salutary and satisfying; but they are insufficient, and do little more than remind us of our wants.

I doubt not that such a thing as a thorough and perfect system of constructive building would be, at the present day, one of the most eagerly-purchased works that could be written in connection with our profession; and one would think that there are few subjects which offer to a scientific man of leisure so many promises of satisfaction. All we want is a diligent and clear-headed compiler of evidence and collector of facts; the materials are to be found anywhere, all ready to his hand,—stones upon the highway,—his work merely to collect, arrange, describe. It would not be amiss if certain energetic minds amongst us, instead of labouring to reduce to rule and order that which has no rule and order but in far deeper and more subtle elements than they seem capable of attaining to, would rather devote themselves to the investigation of useful truth in this less ambitious but more profitable path: verily, it is a pity that some of the spare enthusiasm, which has been of late years expending itself so earnestly and withal so noisily in measurements of crumbled walls, and rubbings of brasses, and torturings of the plans of old churches to reduce them to what is considered "geometrical proportion" (regarding which I would only suggest that it is quite possible, and there is no harm in admitting, that the old monks schemed their plans by all those ingenious fancies, provided you do not lose sight of the circumstance that in so doing they schemed their plans very foolishly, and wasted their ingenuity upon a very wild chimera)*—verily it is a pity, I say, that some of this spare enthusiasm should not now, by way of change and relaxation, if nothing else, attach itself to measuring principles of science, and rubbing down facts into system, and reducing plain, honest, useful knowledge to its plain, honest philosophy.

But I must pause to say that, perhaps, I am wrong in thus attributing to the construction of an encyclopædia of building so small an amount of difficulty. The task, if not one of deep thinking, as thinking goes now-a-days, would still be found in amount of research sufficiently laborious, and in variety and extent of comprehensiveness sufficiently perplexing, and demandant of scientific discernment and care, to entitle a properly complete and minute fulfilment of it to all the fame and merit of a great work: for, to be useful, it must be complete and minute, elementary and of thorough explication; not such a treatise as those of Gwilt and Bartholomew, although these are very praiseworthy in their way—so far as they go; but investigation of a more precise and painstaking manner, in a more formal and logical way, as if Professor Willis taught, or Dr. Arnott, or John Stuart Mill, or Linnæus, or Bacon, or Euclid of old. And in passing I would say that I have often regretted that the explications of Professors Donaldson and Hosking in the routine of their professorships should not be in some measure published, although it were merely in abstracts of what may happen to be novelties; without any chance of evil that I can think of, the suggestions and acquisitions of our two professed systematizers of the science, might, in such a way, most honourably to themselves, be made of important use, in reducing to a standard and authority what at present is too much left floating about in all the uncertainty of crude opinions, experiments, secrets, and tricks of trade.

The Encyclopædia of Building I would have to commence, of course, at the fundamental and primary. First, a somewhat voluminous subject, if rightly and fully discussed, is that of *plan*, an investigation of the arrangement of buildings in all departments of requirement and circumstance,—the explanation of *the system of buildings* fundamentally—the laying down and determining, as the commencement of the first proposition, what a building is. In the question of *site*, next, there is a good deal of philosophy to be opened up; climate, soil, level, access, approach, aspect, view, water, air, drainage, foundation, are subjects capable, every one, of considerable discussion. After which come the long array of *building operations and materials*—the digger, well-sinker, bricklayer, stone-builder, lime-maker, mason, pavier, slater, thatcher, carpenter, plasterer, joiner, plumber, smith, carver, glazier, painter, paperer; the brick and tile maker, quarrier, lime-burner, timber dealer, founder, ironmonger, glass-maker, and the rest in connection: all these in all the departments of their crafts,—not merely the tools they work with and the descriptions of work they do,—but the intricacies of what they themselves do not attain to—the science and *rationale* of their work and all their doings,—every process and every purpose and every preference and every piece traced logically to its principles and its science,—not a mere hasty statement of general axioms of practice, a mere dictionary of

* The cubic contents of the Eddystone are 13,343 feet.

† Read at a meeting of the Architectural Association, June 9th. For former portion see p. 265, *ante*.

* The harmonious result of this "foolish" scheming induces in us a very different opinion of it.—ED.

terms and description of common self-evident operations, but a thorough and complete discussion of the philosophy of the thing—a searching inquiry into the elements of its cause and effect, its right and wrong, its better and worse.

Still, if all this appear complex, the complexity is only seeming; greater complexity than this is every day reduced to system in other knowledges; a clear head and precise pen would soon sort it into simplicity; and I can only say that I wish it were fairly and diligently and knowingly attempted. The successful result would be a benefit immensely to the learner as his most valuable teacher, and by no means inconsiderably to the most experienced practitioner as his standard of reference for guidance, suggestion, explanation.

Although I have stated my fancy of Mr. Donaldson's constructional maxims carrying with them a sort of disappointment from their fewness, yet it does not follow that we neglect the appreciation of them individually. Many of them present to the attention sound principles much neglected; in some those intimate with the subject will find the merit of valuable and suggestive novelty; while, generally, if they do not attract us more forcibly, they attract us thus, that they are good hints for inquiry; excellent texts, for instance, to found illustration, discussion, conversation, upon. If I could sufficiently depend upon my own judgment in minutiæ, there are several of these maxims upon which I should like to offer illustration and suggestion; but I will rather beg you to be contented with a more general notice.

Maxim 106.—"The rot in timber germinates in damp, expands in heat, but shrinks and dies in perfect ventilation," struck me as carrying, under very much the semblance of a truism, a valuable precept of practical application—the need for providing much more than is generally done for the ventilation of timber-work in a building. When we lay the end of a girder, with an inch or two of space round it, in the wall, we are only providing what, I apprehend, ought just as carefully to be provided in many cases where it seems to be never thought of. The decay which the opening up of an old house exposes, often even when it is not so very old after all, ought to set practical men thinking more than it seems to do.

No. 109. "Water is the most destructive agent to construction. There is no quantity so small which, if repeated, is not ultimately fatal." That buildings should be attentively kept water-tight cannot be too rigorously insisted upon. It is not sufficient that torrents of wet shall not be permitted to produce ruin in ten or twenty years; but drops are enemies, only differing in degree. What a pity it is, for instance, to see many of our mediæval churches in helpless ruin, through this insidious destroyer, beside others, where a little additional care—a stitch in time hundreds of years ago—results in preservation of the whole structure in its strength!

No. 110 relates to a similar subject,—"Our forefathers knew the connection between moisture and decay in soft material. Hence in the buildings of the districts where the soft stones prevail, the bottom courses of the walls will frequently be found to be formed of a hard and impervious stone, the strata of which are called by the quarrymen foundation-stone." Besides the injury which damp occasions in the structure of a wall, and the woodwork in connection with it, we have a more serious reason still for care in the prevention of the transmission of moisture from the ground, in the manifold discomforts so commonly to be met with in that *multum in parvo* of annoyances, a damp house. The precautions of eaves-gutters, so that the roof-water may not drip on the foundations, dry areas round the basement walls to provide against the direct transmission of damp to apartments underground, sloping the surface up to the walls so as to draw the surface water off from the building, and so on, are only the ordinary provisions in the case, although too frequently foolishly neglected; but, in all instances of general brick building, the common qualities of bricks are such excellent conductors of wet that there never can be harm, when the soil is at all more damp than dry, in providing for the non-transmission of moisture by some such means as a couple of courses of slates in cement just above the ground, a cheap preventive of the chance of a most serious evil.

Some will also have hollow walling—the bond-skeleton of the brickwork without filling in—to provide against the transmission of damp directly through the wall from driving rain; but I should be disposed to question the efficacy of this, except the ventilation of the interior of the wall be more depended upon than the mere lessening of the quantity of conducting surface. In exposed situations, as on the coast, an approved method of building is in two distinct thicknesses of wall (as, for instance, a 9-inch wall outside and a 4½-inch wall inside) with a clear space of about 3 inches between them, the two thicknesses being connected together by iron bonding ties. Special care is insisted upon, not only that there shall be no brick connection of the two thicknesses (except, of course, in the jambs of openings), but that no bats or rubbish shall be let fall into the interior space, lest the moisture should be carried through by such means; and openings are provided to be left during building in the outer thickness at the ground for removing any pieces of mortar, or such like, which may happen to be allowed to drop down. If this should wear a little of the appearance of affectation in some respects, yet, after all, it is to be remembered that in the matter of a damp house a very small amount of prevention is better than a vast deal of cure. Battening is, of course, quite another subject, and the most effectual preserver of dryness provided it be itself kept dry.

Maxim 120—"The Freemasons of the middle ages have established this principle of construction, that, with equal quantities of material, a thin wall, with buttresses, has greater strength and stability than a thicker wall without,"—is worthy of being kept in view in these days of economy.

Maxim 136—"The material available must frequently have determined the style of art;"—"the like consideration controls the introduction of more or less ornamental detail in edifices," deserves to be taken very much to heart by those who would aim at a true spirit of design. How seldom do we find an architect regulating his design by his materials; his principle is rather to choose his design from the standards, and then do a world of scheming to carry it out with the material prescribed! To keep strictly to the facts of the nature of the material is, one would think, a rule so merely axiomatic as to scarcely need mention; but in our day architects in general never think of it, their axiom is rather always to disguise your material in the likeness of a better—a fallacy most gross and unworthy of intellect!

A few good sentences are given on mortars, timber, and iron; but it is manifest that little can be compassed on subjects like these in space so small; the architectural world requires treatises on such subjects like those of Pasley on the first, and Tredgold on the others, simply professionalized.

Let me pass now from constructive science to the walk and conversation of the architect. And upon this and Mr. Donaldson's valuable lecture on it, I must be content to speak very briefly. In fact, I can do little more than reiterate his excellent precepts. In acquiring the knowledge of a profession, whose knowledges are so many and comprehensive, diligence, attention, perpetual inquiry, persevering research, are merely the absolute necessaries of advancement. In assuming the position of a practitioner in a profession, where shortcoming and makeshift and empiricism are so much more prevalent than sound knowledge and good confidence of skill, the utmost endeavour, after thorough and systematic acquirement, is what alone can produce honourable standing. And in self-advancement in a profession, where such a custom as our competition-system gives so many (too eagerly embraced) opportunities for self-advancement by dishonour, such counsel as Mr. Donaldson's to highmindedness, integrity, and ambition for true fame, is the surest in the end to be the best to follow. Everyone knows Professor Donaldson to be eminently the friend of the student; and he possesses not a prouder diploma in his collection than the acknowledgment of this. I will therefore conclude with the sentiment of my commencement, that in laying before you the remarks now completed, I have the advantage of feeling that my subject must have been to you most interesting; and when we thus favourably end our examination of his work, there is no harm, perhaps, in calling to remembrance, that we owe Mr. Donaldson additional honour for the kind countenance which our own Architectural Association obtained from him at its beginning, and the hearty expression of goodwill by which he inspired us with confidence, and in no small degree contributed important help. ROBERT KERR.

WHAT ARE THE CROWS' NESTS FOR?

ORDNANCE SURVEY OF THE METROPOLIS.

THE Ordnance survey observatories (humorously designated "crows' nests" by the metropolitan wags), on the tops of some of the highest buildings in the metropolis, have latterly attracted a good deal of attention, and given rise to inquiries which shew that considerable misapprehension exists respecting them: this the following remarks may probably dispel.

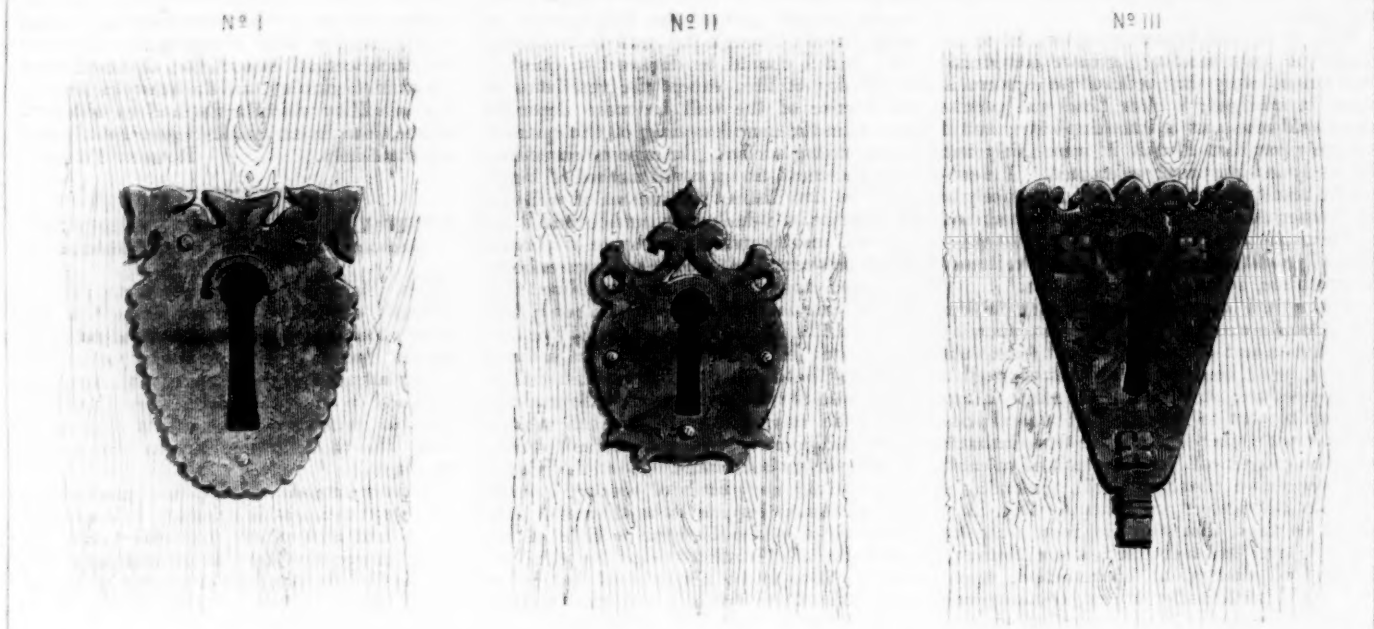
In every extensive survey, conducted with a due regard to scientific accuracy, it is a matter of the first importance to determine with unerring correctness the relative distances and bearings of the principal or most conspicuous objects within the country or district to be surveyed. To effect this, the first operation is to measure a "base line"—that is, a straight or right line between two points, varying in length according to the extent of the survey and the facilities afforded by the nature of the ground for the measurement. As the accuracy of all the subsequent operations of the survey must necessarily depend upon the correctness of the measurement of the base, the most scrupulous care and many ingenious expedients are resorted to in order that the utmost practicable degree of accuracy may be attained. It is not here intended to describe in detail any of the important base measurements that have taken place in this or other countries; suffice it to say, that glass rods, deal rods, steel bars, steel chains, compensation bars (that is, bars of different metals so arranged that, like Harrison's Gridiron Pendulum, they counteract each other's expansion during changes of temperature), have been severally used in different countries in the operation.

The base line being measured, the next step is to connect its extremities by means of angles taken with theodolites or other angular instruments, with all the conspicuous objects visible; the relative distances and bearings of which with each other, and with the base, become thus determinable, by means of certain well-known trigonometrical formulæ. By selecting the most suitable of these observed objects for new observing stations, the calculated distances become, in their turn, base lines for expanding the operations of the "triangulation," until the whole country, by a connected line of observing stations, becomes united or interlaced by a perfect net work of triangles, the distances and bearings, the latitudes and longitudes of which are all unerringly ascertained.

This "triangulation" forms the basis *or* groundwork for an accurate detailed survey of the entire district or country over which it has extended, and obviously affords accurate data for detecting or eliminating all practical errors of measurement or other *detail*—operations which may, and inevitably will, in the progress of extensive works, creep in, with the most careful surveyors. It also affords the means, and the only means, of making a connected survey of a country or extensive district; that is of making (or giving the means of doing so) the several parts of which it is composed harmonize and fit together, which, without the binding power of a general "triangulation," would be impossible.

These preliminary observations being understood, the mystery of the appearance of the present metropolitan aerial visiters will at once disappear. They are simply taking angles with theodolites from the most commanding objects to the other remarkable objects, such as church spires, or towers, cupolas, factory chimneys, &c. &c., within the visual range of their instruments, for the purpose of ascertaining their relative bearings and distances; and where these permanent objects are not suffi-

ANCIENT ESCUTCHEONS.



ciently numerous, or are unsuitable for the purpose, to form the basis or groundwork of the contemplated survey, artificial objects, such as poles with crosses, have to be erected to complete the necessary connection of accessible objects or stations.

The area intended to be comprised in the metropolitan survey is something above 200 square miles, or nearly 130,000 acres; and as the map is to be constructed on the very large scale (for a district of such an extent) of 60 inches to a mile, or 1 inch to 88 feet, which, when completed, will occupy about 900 sheets 3 feet by 2 feet, or about 5,400 square feet of paper or copper,—it would be utterly impossible to make the survey and project the map on such a scale, so that the several consecutive parts or sheets shall combine and fit together to form one entire map of unquestionable accuracy, if every possible precaution (and the number and extent of these precautions can only be known to practical professional men), were not rigidly attended to in the outset with the preliminary part of the work.

But what, ask some simple-minded men, have the "crows' nests" on the tops of the steeples to do with "levelling" the ground for sanitary improvement? Nothing whatever, directly; but everything as forming an essential part of an indivisible whole. These simple but inquiring men and local legislators, who appear to have cudgelled their brains more about this weighty matter than Shakespeare's gravedigger did *his* to fathom the profound depths of his companion's philosophy, should know that correct levels are comparatively useless without a correct map to insert them on; that a correct map cannot be produced without a correct survey; and that the essential preliminary part of this correct survey is the "triangulation," which has served during the last few weeks as a standing *butt* for the wit of some of the city deputies.

The London survey will be connected by its triangulation with the general survey of the country, and in its levelling with the one uniform datum plane to which the altitudes of the Ordnance six-inch map are referred. By this means, when the map is complete, the relative level of any two points within the eight mile radius of the metropolitan survey, or of any part of London, and any part of the north of England, may be seen at a glance by those who require and know how to look for the information.

SCARBOROUGH ARCHÆOLOGICAL SOCIETY.—A meeting of this society was held at the house of the president, Dr. Murray, on Thursday evening week, at which Dr. M. read an interesting paper on the history of coinage.

EXAMPLES OF OLD IRONWORK.

THE accompanying escutcheons may be useful for imitation; they are each simply formed out of the sheet-iron, without any chamfers whatever. No. 1 is from the church at Ixworth, in Suffolk; No. 2 from Westminster Abbey; and No. 3 from the south door of the little church in the grounds of Hengrave Hall, Suffolk. No. 2 is of the latter part of the fifteenth century, and Nos. 1 and 3 are rather earlier.

THE ORGANIZATION OF LABOUR IN FRANCE.

EVENTS in France have fully borne out the views we took in the first instance, and justified the advice we ventured to give. The installation of the workmen (pardon us—of the idlers) in the palace of the Luxembourg and in the national ateliers, was the grandest and most romantesque exemplification of the installation of "the beggar on horseback," that the wondering eye of the world ever saw. The profits of the ateliers ought at least to have paid for the luxuries of the Luxembourg; but the candle, the lux, burnt splendidly at both extremes, only the light of the Luxembourg-turned-upside-down was smothered in the streaming excess of its own incontinent fat. The luxurious lounging of the ouvriers on the lordly cushions of scarlet and gold in the palace of the peers, formed one of the most striking and picturesque *scenes* in the opening of the revolution. Evil omens were but too rife and but too truthful. In sheer consistence, it behoved the lordly table to be furnished and *set out* as nobly and luxuriously as the arm chairs were: and it was so. Monsieur Louis Blanc and his committee of labourers though not labouring committee, accomplished the laborious task of consuming 350,000 francs, in the shape of ros-biff and other *pieces de resistance*, fruits and cordials, ices and *Blancmanges;* or more properly, they chalked up a score to that amount, in a couple of months, to be settled out of the profits of the ateliers not yet reaped. We are not aware that they have done any thing else, but in all probability they have in this done even more than enough; and no one can deny that what they have thus done they have well done and quickly. "Oh sumptuous republicans and sybarites," said the *Constitutionnel*, in apostrophe, hopeful of a crop of figs from a bunch of thistles, "we shall say nothing about your luxurious habitation if you only refrain from encouraging chimerical hopes and dangerous and unjust demands. Let your leisure hours be charmed by the most varied amusements and by the arts, only do not in return reward us with *emeutes*. Voltaire exclaims, in one of his epistles—

'Rimons, chantons, buvons, mon cher Horace!'

Eh bien! dear Provisional Consuls, follow the counsel of Voltaire—rhyme, drink, but do not ruin us! Tolerate in others a little of the luxury you require for yourselves, and which employs so many hands. Let those palaces, those *chefs d'œuvre* of statuary and painting elevate your minds and souls, and inspire you with dreams of days of concord, prosperity, and grandeur, for France."

In the meantime, however, there has been little prospect of the advent of any such fruits. The fear of these very emeutes at this moment harasses the Government and the people at large. The prospect of that very ruin stares them in the face. The expenses of the nation, a large portion of them for the *ateliers nationaux* throughout the country, have exceeded its ordinary resources by no less than 2,600,000 frs. per day since the 25th of February, while these ordinary resources, from the suspension of industry mainly arising out of the illusory hopes emanating from the Luxembourg, and the consequent refusal of the industrious classes to obey their normal leaders and guides, the masters, have been reduced to comparatively nothing. The actual cost of the Paris *ateliers* alone has increased to 10,000*l.* sterling a-day. "The expenditure of these *ateliers*," says a Paris correspondent of the *Globe*, "is frightful, but it represents little more than one-twentieth of the total waste of money in France for the support of the working classes in idleness or unprofitable labour. Let us suppose that, directly and indirectly, the *ateliers nationaux* of Paris have cost the state in three months 90 millions—and this is an under estimate. Multiply this by 20 for the whole of France, in Government grants, or by the votes of municipal councils, and we have a sum of 400 millions expended, at least four-fifths of which was for idleness or unproductive labour. In Paris, when the Government ordered preparations to be made for the fête, a certain number of carpenters was required. These men had been receiving 2f. a-day on earthwork; they were offered 5f. for the erection of the scaffolding for the statues and the illuminations; they refused to work under 8f., and the Government submitted to the extortion. * * *."—In short, the enormity of the evils which we from the first prognosticated, as the inevitable fruits of the Luxembourg legislation, is only now being revealed. The National Assembly, however, have taken the bull by the horns, but they have an unruly and powerful monster to

subdue. They have decreed a law for the *reformation* of the national *ateliers* by the substitution of *task work* for nominal day labour, and by the dispersion of provincial workmen; but they do not appear to contemplate the possibility of doing more, in the meantime at least, than merely re-organizing them, purging them of many idlers who have other resources, and thus reducing their numbers in Paris to about 90,000.* The Minister of Public Works is said to be preparing more detailed plans by which constant employment would be secured to this goodly number, and a sub-committee has been appointed to bring about a friendly arrangement between the masters of several branches of industry and their workmen. The Minister of Agriculture and Commerce has announced a Bill for the creation of fifty agricultural colonies *mobiles*, for undertaking, on a grand scale, works of irrigation and draining in different parts of the territory. The real workmen themselves, it is said, approve of all that is being done; but the idlers, the gamins, the paupers, the convicts and other thieves amongst them, of course deny the propriety of any thing likely to compel them to live upon the fruits of their own actual labour. They have made a handle, too, of the dismissal of their chief, leader, or 'father,' as they call him, namely, M. Emile Thomas,—a young man of five-and-twenty, whom the Government have seen fit to remove from his post, and send off to Bourdeaux on rather an equivocal 'mission.'† A general strike of the people employed on the railways was lately forming a new cause of anxiety at Paris. The Directors, however, backed by the Government, determined not to submit to the unreasonable demands of the engineers and firemen, who are bent on the discharge of all the remaining English workmen employed, and they meant to adopt the most energetic measures to defeat a personal attack threatened against the Englishmen employed on the Rouen railway.

THE DRAINAGE QUESTION.

DRAINAGE IN MANCHESTER, LIVERPOOL, AND CHESTER.

SIR,—The absorbing topic of the day is sanitary remedies, and it appears, now their importance becomes better understood, that towns are vieing with each other in carrying them into effect, so far as their means will allow.

The expense attending efficient sanitary arrangements will be the greatest obstacle to their extension; and when it is known that it will require at least fifty millions of money to carry them out, so far as the public purse is concerned, and an equal sum for the owners and occupiers of property for private sanitary arrangements, in Great Britain alone, we cannot wonder that the progress is slow, and that considerable opposition is thrown in the way.

This result has been obtained from approximate estimates and data from various towns.

In Manchester, a *radical* "change has come over the spirit of their dream." Sewers of brickwork are to be abandoned, and tubes, composed of fire clay, adopted in their stead. The sizes and relative cost of the two systems are as follow :—

TUBES.

Inches.		Cost.			
25×18	.....	£0	8	0	per yard linear.
20×15	.....	0	6	6	,,
16×12	.....	0	3	9	,,
12× 9	.....	0	2	0	,,
8× 6	.....	0	1	4	,,
6× 4	.....	0	1	0	,,
4× 2½					

Exclusive of excavation and setting.

OLD SEWERS.

Inches.		Cost.			
72×38	.....	£2	0	0	per yard linear.
60×36	.....	1	15	0	,,
42×24	.....	0	17	3	,,
36×24	.....	0	15	4	,,
33×22	.....	0	15	0	,,
30×20	.....	0	14	0	,,
24×18	.....	0	13	4	,,
20×15	.....	0	12	6	,,
15×12	.....	0	8	3	,,

Excavation included.

Thus, it appears the area of the tubes is about one-sixth of the area of the old sewers.

Manchester has groundlessly set up a claim as the inventor of the egg-shaped tube for the purposes of drainage, and the terra-cotta syphon trap, notwithstanding the former was suggested in the Sanitary Report of 1844, page 363, and the latter in your journal for 1844, page 594; and it appears they were not introduced into Manchester until 1847. The invert of the Manchester tubular sewer is of the shape of a Gothic arch inverted, and, I understand, the *exterior* surface is glazed.

Before tubes can be generally introduced for the purposes of drainage, manufacturers must considerably reduce their prices, as I find sewers can be constructed of brickwork at a cheaper rate, even of one-third larger area. I cannot see the great objection to sewers composed of brickwork, provided there is no waste of material, and they are properly and substantially constructed — viz., with good radiated bricks set in cement or lias lime; for, when a good fall can be obtained, and a system of flushing adopted, I quite agree with Mr. Austin, in the Sanitary Report, "that, in such situations, all difficulty ceases." Again, tubes have not yet been manufactured larger than 25×18 inches. This is of sufficient size to drain only small areas; but main sewers to drain large areas must still be composed of brickwork or moulded blocks: the latter are the most costly. In Liverpool slow progress is made in the extension of their sewers; for, notwithstanding their great wealth, a difficulty is experienced, in these times of monetary depression, in procuring the "sinews of war," while they have ample powers, under an Act recently obtained, to carry out, to its fullest extent, sanitary remedies, and a large engineering staff, costing from 7,000*l.* to 8,000*l.* per annum.

In Liverpool, tubes are used for house drainage and the drainage of courts, and I understand it is intended to drain one of the smaller streets with glazed tubes. The sewers of the larger size are composed of brickwork, and in shape very much resemble those of Mr. Roe, in the Holborn district. The corporation of Liverpool having the water-works in their own hands, have now the means of flushing the sewers, whenever required, economically, though, I apprehend, a supply of water for that purpose might be obtained, at a cheaper rate, from the river Mersey, more particularly as it is stated there is deficiency of water now for domestic purposes. An interesting controversy is now going on relative to the better supply of Liverpool with water. The Rivington Pike scheme is condemned, and it is maintained that a sufficient supply can be obtained from the strata of the new red sandstone upon which Liverpool is founded. Another scheme is to obtain a supply from Bale lake; but I should conceive that a plentiful supply of water for Liverpool and other towns situated on the route, might be obtained from the river Dee, without ascending so high as Bale lake, and at much less cost. The street traps in use at Liverpool are the old valve trap, and Burton's registered trap: the syphon trap has not yet been introduced.

It has been recommended in the pages of the *Civil Engineers' Journal*, to erect large chimney shafts at elevated points, connected by tunnels with sewers, and the sewers with the flues of houses and factories, so as to afford a passage for smoke and offensive effluvia, and at the same time be the means of supplying pure air to the streets, courts, and houses. The principle of the plan is not new, as at some of the copper works in the manufacturing districts of South Wales subterranean shafts or tunnels are used for the purpose of collecting and conveying away the smoke and vitriolic fumes to the summit of the adjacent mountain, where it is dispersed in the atmosphere; this is the means of preventing considerable injury to vegetation that would otherwise take place, which travellers between Neath and Swansea cannot fail to have observed.

Birkenhead being comparatively a modern built town, more attention has been paid to the subject of sewage than in most other places: the sewers there are of an area equal in magnitude and strength equivalent to some of the London sewers, and, as a natural inference, must be quite as costly. In some instances, when rock has been found, the inverts of the sewers have been formed in it, and the arches only turned in brickwork. House drainage, I understand, is very deficient. Sanitary remedies have received a check in this town for the want of funds; the authorities, in evincing a spirit of economy, have recently reduced their staff of officers.

In Warrington, I understand, a sanitary survey is in course of execution, anticipatory of the Health Bill.

Chester has made considerable progress in sewages under a Sanitary Act recently obtained; the sewers are being constructed on a more economical system than that adopted in some towns, but the want of means is a great obstacle to their more rapid advancement.

Many of the old drains that were made previous to the Improvement Act coming into operation were so defective in levels, arrangement, and construction, as to render it necessary to take them up; in fact, the whole drainage of the old city nearly, required readjustment and reconstruction, founded upon a correct system of levels.

The main sewers in Chester are costing less per lineal yard, including materials and excavation, than the largest sized egg-shaped tubes advertised in your paper.

A system of flushing is adopted there in situations contiguous to the Chester and Ellesmere Canal, that Company having liberally placed at the disposal of the authorities a sufficient supply of water for that purpose. The sluices are fixed in the side walls of the canal, so that the sewers may be effectually cleansed whenever required. The sewers on the higher levels at present have not that advantage, in consequence of the supply of water being inadequate. A considerable extent of house drainage has been done; it is the practice, whenever a sewer is completed, to serve notices upon the owners of the property to drain their houses. Tubular pipes 4 inches, 6 inches, and 9 inches diameter, are used for the purpose of house drainage, and every house drain is effectually trapped. The traps in use are the syphon and the valve traps; the former have been extensively used for the last two years, and answer exceedingly well. Tubes of glazed stone ware have been introduced, also glazed junctions and syphon traps of different sizes for house drainage. These tubes are manufactured at Ruabon. Glass tubes (an excellent invention for drainage or water pipes) are being experimented upon, with the view of ascertaining their relative advantages over the pipes now in use.

An attempt was made to procure egg-shaped tubes (glazed), but it was abandoned, in consequence of the increased expenses attending them.

I cannot close this article without directing especial attention to the efforts now being made to reduce so *materially* the size of sewers for town drainage. Although no advocate for the expensive and wasteful system carried out in many towns, still I am not one of those that would recommend the other extreme to be adopted. One party advocates sewers of the tubular system of the bare minimum capacity for house drainage only, leaving rain and storm water to find vent how they can, which will occasionally cause serious inundations; another, a separate system of tubes for house drainage and rain and storm water. The former is so directly at variance with the practice of all our eminent hydraulic engineers in the construction of their river bridges, sluices, culverts, water works, &c., that it needs only to be named to be repudiated; the latter will entail a much larger expenditure even than the old system, in consequence of the high price of glazed tubes.

B. B.

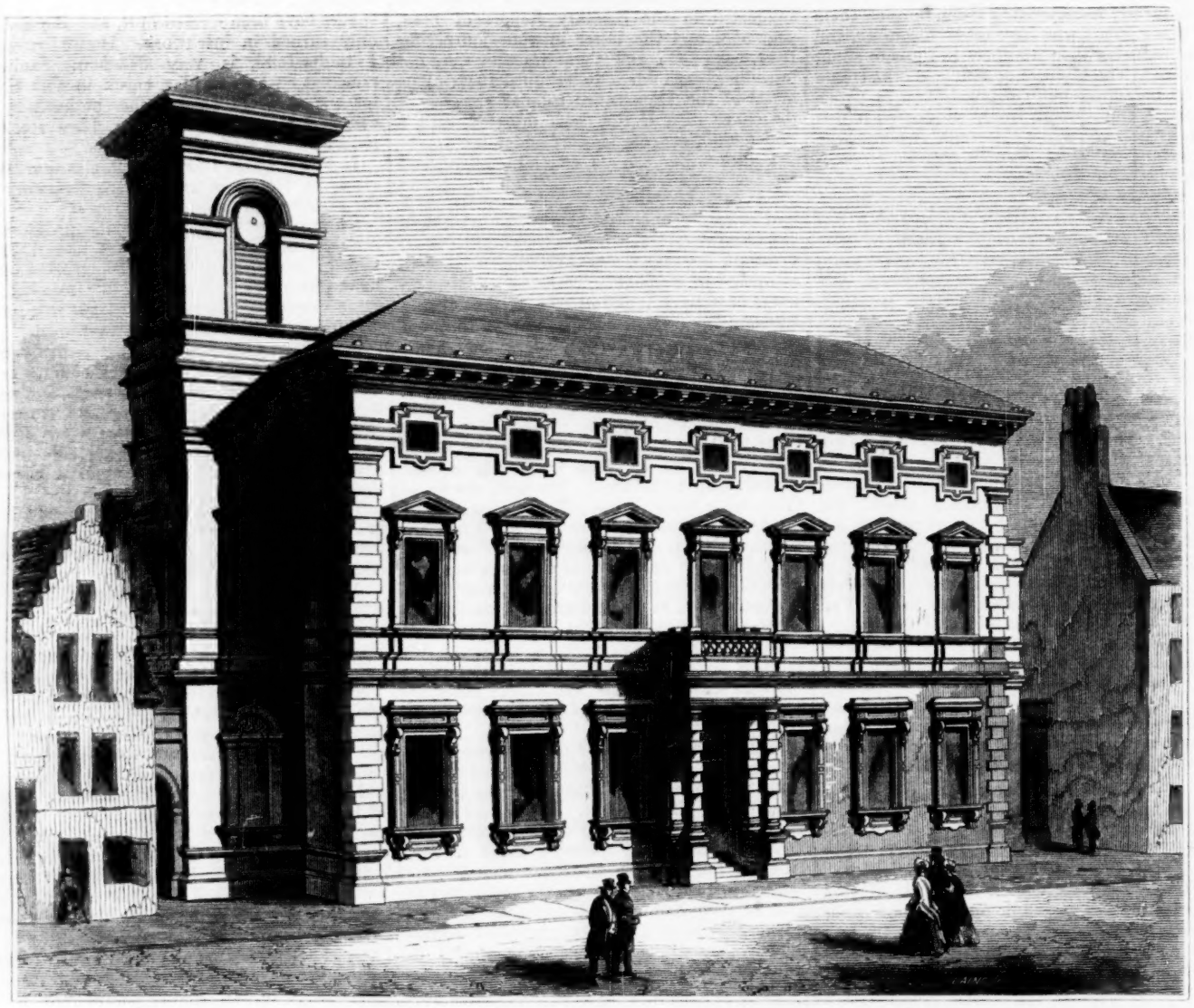
LITHOGRAPHIC STONE.—Among the prizes offered by the Paris Society for the encouragement of Arts and Manufactures, is one of 1,500 fr. (60*l.*) for the discovery and practical working of new quarries of lithographic stones in France; the society being convinced that there exist in many localities of the country, places where lithographic stones may be quarried to advantage.

* The last inspection of the operatives in the national workshops fixes their number at 108,000, independent of 7,000 received on certificates from the Commissaries of Police.

† The machinery of "organised labour" appears expensive at least. The *Journal des Débats* states, that "by the removal of M. Emile Thomas from the direction of the national workshops a saving of from 25,000 to 30,000 francs (from 1,000*l.* to 1,200*l.* a day) will be effected. M. Emile Thomas retained for his service five chariots, four cabriolets, fourteen tilburies, a caleche, and thirty-eight horses!"

THE CORN EXCHANGE, EDINBURGH.

MR. COUSIN, ARCHITECT.



NEW CORN EXCHANGE, EDINBURGH.

THE Edinburgh Corn-market is held weekly, and is both a stock and sample market. The great increase of trade in this market since the opening of the various railways, has rendered an enlargement in the accommodation a matter of urgent necessity. About a year ago, application was made to Parliament by the city of Edinburgh for an Act empowering them to purchase properties in the Grass-market—a large open square in the ancient part of the city—and to erect a new corn exchange of such dimensions as to meet the increased wants of the trade.

The area of the present corn-market buildings, including that of an additional temporary shed provided some years ago, is only about 4,300 superficial feet. The great hall of the new corn exchange is 152 feet by 92 feet 6 inches, containing an area of 14,060 feet, lighted from the roof. In addition to this, there is a large room in the first floor front of the building about 66 feet by 25 feet, for the settling of accounts and other transactions of those attending the markets, with a smaller adjoining room about 25 feet square, which may either be used as a bank, or for other similar purposes. Over these front rooms is a large granary for storing corn, or other seeds, not disposed of at the market.

The annexed engraving shews a perspective view of the front of the new exchange, which, it will be observed, is in the Italian style of architecture, and has a clock and bell tower at one end. Contracts have been entered into for the erection of the building; the estimated expense of which is about 7,800*l*. The design has been supplied by Mr. David Cousin, architect, superintendent of public works for the city of Edinburgh.

ENCLOSURE OF WASTE LANDS.

FORMATION OF EMBANKMENTS.

THE population of the country generally must view with pleasure and with hope the attention which is given in high quarters to the subject of the subsistence, the employment, and the comforts of the poor. Proposals have been made, and measures are carrying out, for transferring to distant climes our overflowing population; but whilst we are sending our able workmen out of the country, let us not lose sight of the important occupations wherein they and their families might be advantageously employed at home.

The waste lands of this country have been computed at 30,000,000 acres, the cultivation of which would support 5,000,000 persons, allowing to each six acres. In former times the Dutch navy disputed the empire of the seas with that of Great Britain; her seamen sprang from the barren sands and mud banks which they enclosed to form their country. How many thousands of cheeses, kegs of butter, and melons, they export to us, the product of these formerly submerged wastes, it is impossible to enumerate.

By Dr. Potts's recent improvement in hydraulic architecture, continuous lines of enclosure may be made on our coasts to an immense extent. At an expense comparatively trifling, cheap tubes may, by the action of the air-pump, be sunk with great rapidity into the sand or other soil, either perpendicularly or obliquely, the strength of a boy being sufficient to force a tube of 9 inches diameter many feet into the substratum. The tube being emptied of its contents by a similar process, is ready to receive bars of iron or wood, by which the embankment, consisting of mud or material brought by inclined planes or otherwise, may be retained. The iron thus employed may be removed when no longer required, and again applied for similar purposes. Cabins, houses, churches, as well as quays, batteries, and breakwaters may by this means be supplied with foundations. A bottomless tub or tube formed of straight staves, with its lower diameter somewhat larger than the upper, may, in one tide, be placed firmly in the sand-bank with its upper aperture above highwater-mark. These tubes may also be made of iron, stone, or composition, so as to form a dwelling for a family, vastly superior to the iron roller, described as an enviable retreat by Lord Ashley in his admirable speech in the House of Commons on Tuesday last. This power is applicable not only to the inclosure of land and the formation of dwellings, but to extensive draining and the deepening of sluices. By laterally restricting the extent of the current, its force, and consequent depth will be increased. By this means vessels of deep draught may conveniently be brought to the piers and wharfs of newly-constructed embankments and mosses, bogs and inland lakes converted into fertile regions.

THEORY OF THE ARCH.

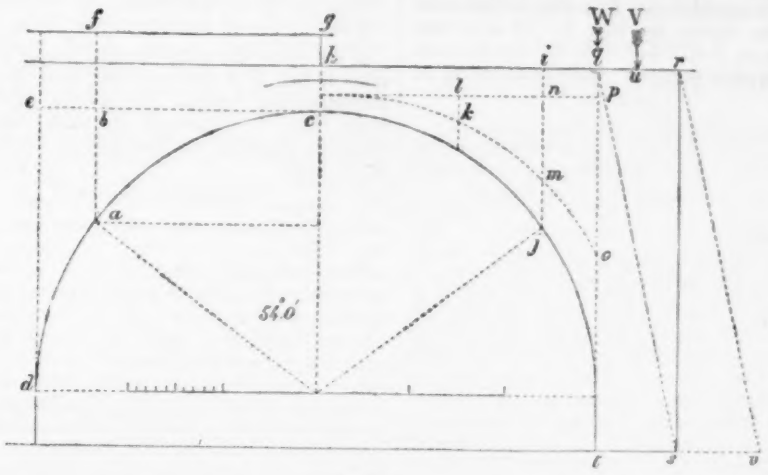


Fig. 1.

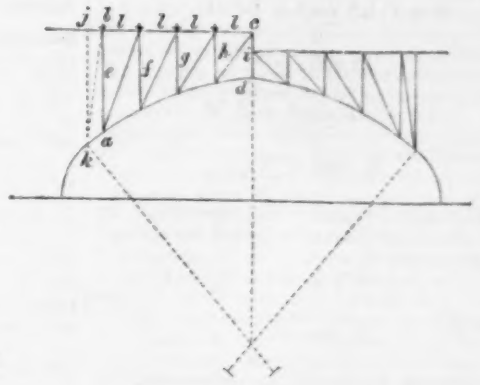


Fig. 5.

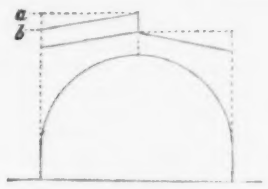


Fig. 2.

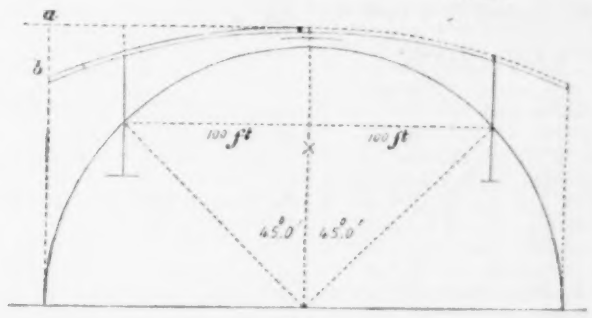


Fig. 3.

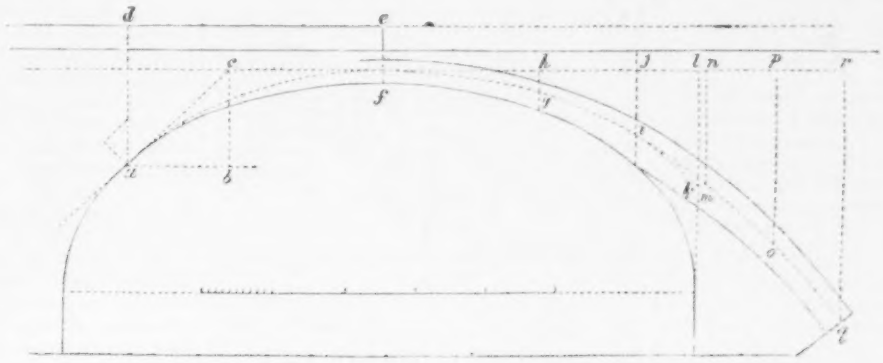


Fig. 4.

THEORY OF THE ARCH APPLIED.*

By means of the annexed table, the points of fracture, the horizontal stress, points in the curve of equilibrium, &c., of circular and elliptical arches, may be determined with considerable accuracy and facility. Its use in comparing bridges of different dimensions, and for other purposes, will be shewn by a few examples.

Table to aid in calculating the Horizontal Stress, &c., of Circular and Elliptical Arches, with various loads.

Circ. Ellip.	Ver-sine R H	Sine R R	$Sine^2$ R^2 R^2	$Sine^3$ R^3 R^3	$Sine^4$ R^4 R^4	A R^2 RH	D R R	M R^3 R^2H
5°	·00381	·08716	·00760	·00066	·00006	·00011	·02171	·000003
10°	·01519	·17365	·03015	·00524	·00093	·00088	·04334	·00004
15°	·03407	·25882	·06699	·01734	·00449	·00292	·06446	·00019
20°	·06031	·34202	·11698	·04001	·01368	·00679	·08498	·00058
25°	·09369	·42262	·17861	·07548	·03190	·01294	·10464	·00135
30°	·13397	·50000	·25000	·12500	·06250	.02169	·12326	·00267
35°	·18085	·57358	·32899	·18870	·10823	·03322	·14067	·00467
40°	·23396	·64279	·41318	·26558	·17071	·04752	·15669	·00745
45°	·29289	·70711	·50000	·35355	·25000	·06441	·17235	·01102
46°	·30534	·71934	·51745	·37223	·26775	·06807	·17388	·01184
47°	·31800	·73135	·53488	·39119	·28609	·07181	·17651	·01268
48°	·33087	·74314	·55226	·41041	·30500	·07564	·17907	·01354
49°	·34394	·75471	·56959	·42987	·32443	·07954	·18157	·01444
50°	·35721	·76604	·58682	·44953	·34436	·08351	·18399	·01537
51°	·37068	·77715	·60396	·46936	·36476	·08755	·18635	·01632
52°	·38434	·78801	·62096	·48932	·38559	·09165	·18863	·01729
53°	·39818	·79864	·63782	·50938	·40681	·09581	·19084	·01828
54°	·41221	·80902	·65451	·52951	·42838	·10001	·19298	·01930
55°	·42642	·81915	·67101	·54966	·45026	·10426	·19504	·02033
56°	·44081	·82904	·68730	·56980	·47238	·10855	·19700	·02138
57°	·45536	·83867	·70336	·58989	·49473	·11287	·19883	·02245
58°	·47008	·84805	·71919	·60990	·51723	·11720	·20078	·02353
59°	·48496	·85717	·73474	·62979	·53984	·12156	·20254	·02462
60°	·50000	·86603	·75000	·64952	·56250	·12592	·20423	·02572
90°	1·0000	1·0000	1·0000	1·0000	1·0000	·21460	·22337	·04794

* For an explanation of the particular theory adopted and applied, see an article under the same title in the fourth volume of THE BUILDER, page 619, to which this may be considered an appendix.

The second column of the table contains versed sines of arcs of a circle; the third, fourth, fifth, and sixth columns, the first, second, third, and fourth powers of sines. The seventh column, headed A, contains the areas of the curvilinear triangles (*a b c*), (*d e c*), &c., Fig. I.; the eighth, marked D, the distances of their centres of gravity from their vertical sides (*a b*), (*d e*), &c.; the ninth, marked M, their moments;—the whole corresponding to arcs of the number of degrees figured in the first column, the radius being unity. The values of the quantities corresponding to any other radius or semi-span, R, are to be obtained by multiplying the dimensions of the table by the powers of R, shewn in the first line under the heading of it. For elliptical arches, the quantities in the second line are to be used, in which R is the semi-span and H the rise. The values of A, D, and M were calculated by the following formulæ—

$$A = \frac{\text{sine} \times \text{ver-sine} + \text{sine} - \text{arc}}{2}$$

$$D = \frac{\text{sine} - \frac{\text{ver-sine}^2}{2} - \frac{\text{ver-sine}^3}{3}}{A}$$

$$M = A\ \text{sine} - \frac{\text{ver-sine}^2}{2} + \frac{\text{ver-sine}^3}{3}$$

To find the area proportional to the horizontal (S) of a semi-circular arch loaded as represented by Fig. 1. To the moment of (*f b c g*), add the moment of (*a b c*), and divide the sum by the versed sine (*c h*), added to half the depth of the key ($\frac{K}{2}$). If the

centre of the motion (*a*), be so chosen, that the result obtained is greater than if any other point in the intrados were chosen for a centre of motion, it is the area sought for, and (*a*) is the point of fracture. If the whole thickness of the arch and load at the crown (*c g*) is called T,

$$S = \frac{T.R.^2 \frac{\text{sine}^2}{2} + R.^3 M}{R.\text{ vers.} + \frac{K}{2}}$$

$$S = R^2 \frac{T.\frac{\text{sine}^2}{2} + R.M}{R.\text{ vers.} + \frac{K}{2}} \quad (1)$$

If the arch be loaded as represented by Fig. 2, the fall of the load (*a b*) over the springing being called F,

$$S = R^2 \frac{T\frac{\text{sine}^2}{2} + R.M - F.\frac{\text{sine}^3}{6}}{R.\text{ vers.} + \frac{K}{2}} \quad (2)$$

If the arch be loaded as represented by Fig. 3, the roadway being parabolic, and the ordinate of the parabola (*a b*) over the springing called F,

$$S = R^2. \frac{T.\frac{\text{sine}^2}{2} + RM - F.\frac{\text{sine}^4}{12}}{R.\text{ vers.} + \frac{K}{2}} \quad (3)$$

to find the values of S, for elliptical arches loaded in a corresponding manner to the above (compare Fig. 1 with Fig. 4), for RM and R versedsine in the formula 1, 2, and 3, substitute HM and H versedsine. In the formulæ so altered, R is the semi-span, and H the rise. Thus the rule for finding S for the bridge, represented by Fig. 4 is,

$$S = R^2 \frac{T.\frac{\text{sine}^2}{2} + HM}{H\text{ vers.} + \frac{K}{2}} \quad (4)$$

In the absence of tables, or when the formulæ are intricate, the simplest way, perhaps, to make these calculations is to divide the area of the section into triangles by equidistant parallel vertical lines and diagonals, and to compute the contents and moments of the different triangles as though they were rectilinear; thus the area (*abcd*) Fig. 5 is nearly equal to

$$l \times \left(\frac{e}{2} + f + g + h + \frac{i}{2}\right) \quad (5)$$

Its moment nearly equal to

$$l^2 \times \left(\frac{e}{6} + f + 2g + 3h + \frac{3i}{2} + \frac{i}{3}\right) \quad (6)$$

and the distance of its centre of gravity from (*ab*) is nearly equal to the second of these two formulæ divided by the first. If the point in the intrados (*a*) first assumed be not near the point of fracture, let some other point, as (*k*), be assumed (above or below it, as the case may require), and let the moments of the two dotted triangles (*abk*) and (*jkb*) be added to (or deducted from, if necessary) the moment of (*abcd*) with regard to the point (*k*). By varying this point and using the moment so obtained, the horizontal stress may be arrived at quite near enough for practical purposes.

To find an ordinate to the line of equilibrium, divide the moment of any part of the section, as (*afgc*) or (*chij*), fig. 1, by S. Thus, the rule for finding the ordinate (*kl*) equal to Y, (*ch*) being called (*t*), is,

$$Y = \frac{\text{Moment of } (chij)}{S} = \frac{R^2.\left(\frac{t.\text{sine}^2}{2} + RM\right)}{R^2.\left(\frac{T.\text{sine}^2 + RM}{R.\text{Vers.} + \frac{K}{2}}\right)} = \frac{\left(\frac{t.\text{sine}^2}{2} + RM\right)}{\left(\frac{S}{R^2}\right)} \quad (7)$$

To find the linear or columnal measure of the horizontal stress divide S by K.

$$C = \frac{S}{K} \quad (8)$$

To find the tangent to the curve of equilibrium at any point, as (*a*), fig. 4. Upon a horizontal line drawn from the point, set off with any convenient scale (*ab*) equal to S, and on a perpendicular line through (*b*), (*cb*) equal to the area (*adef*), the line between (*a*) and (*c*) is the tangent. When the tangent of the curve of equilibrium, at any point, agrees with the tangent of the intrados of an arch, at that point, it is a point of fracture.

Examples.—Required S the area proportional to the horizontal stress of a semicircular arch, loaded as shewn by Fig. 1. R = 30 feet, T = 7·7121, K = 3 feet. By the first formula, assuming the point of fracture to be at 54 degrees,

$$S = \frac{30 \times 30 \times 7{\cdot}7121 \times \frac{{\cdot}65451}{2} + 30 \times {\cdot}0193}{30 \times {\cdot}41221 + \frac{3}{2}} =$$

201·375 feet.

By a similar operation the value of S to 53 degrees was found to be 201·333, and to 54 dgrees 201.339. The point of fracture is very nearly at 54 degrees; the thickness at the crown having been previously calculated that it might be so. The trifling difference between these results shews that an error of a degree or two in determining the position of the points of fracture is of no importance.* This will appear more evident from the linear or columnal measure of the horizontal stress deduced from the above approximations to S. (8th) Rule.

$$C = \frac{201{\cdot}375}{3} = 67{\cdot}125$$

$$C = \frac{201{\cdot}333}{3} = 67{\cdot}111$$

$$C = \frac{201{\cdot}339}{3} = 67{\cdot}113$$

The greatest difference between these is only a sixth of an inch.

Required the ordinates (*kl, mn, op*) of the line of equilibrium, corresponding to 30, 54, and 90 degrees of the intrados; the depth of the permanent load and arch (*t*), at the crown, being 4·5 feet. By the seventh formula,

$$Y \text{ to } 30° = \frac{4{\cdot}5 \times \frac{{\cdot}25}{2} + 30 \times {\cdot}00267}{\left(\frac{7{\cdot}7121 \times {\cdot}65415 + 30 \times {\cdot}0193}{30 \times {\cdot}41221 + \frac{3}{2}}\right)} =$$

$\frac{{\cdot}6246}{{\cdot}22375} = 2{\cdot}871$ feet.

$$Y \text{ to } 54° = \frac{2{\cdot}0516}{{\cdot}22375} = 9{\cdot}169 \text{ feet.}$$

$$Y \text{ to } 90° = \frac{3{\cdot}6882}{{\cdot}22375} = 16{\cdot}483 \text{ feet.}$$

Required S for an elliptical arch loaded as represented by Fig. 4, the semi-span R = 45 feet, the Rise H = 30 feet, T = 7·7121. K = 3 feet.

All the quantities forming the fractional part of the fourth formula are the same as in the previous example, the only difference is in the squares of the semi-spans.

30 : 45 :: 1 : 1½. 30² : 45² :: 1 : 2¼.
S = 201·375 × 2¼ = 453·093 feet.
C = 67.125 × 2¼ = 151·031 feet.

The ordinates (*g h*), (*i j*), (*k l*), are the same as those previously determined. The points of fracture have very nearly the position of those of the bridge of Nogent-sur-Seine, determined from observation by Peyronnet.

* M. Garidel has calculated the points of fracture and thrusts of various semicircular bridges, upon principles somewhat different from those here adopted—the points of fracture to a hundredth part of a degree. M. Garidel's thrust is the pressure which one part of an arch, with its load, will exert to overthrow the remaining part and the abutment wall, if the curve of equilibrium be supposed to touch the extrados of the arch at the crown, and the intrados at two points. The thrust so estimated does not appear to the writer to be the true stress or pressure upon the materials. The resistance is in every particle of the vertical section of the key, and the resultant resistance of the particles, if the section be rectangular, is at the middle of the depth; with this resultant, according to the principles first explained by Galileo in his dialogues on the resistance of solid bodies, the stress should be equated, otherwise the resistance of the materials must be supposed to exist in the upper edge of the arch alone, and consequently to be enormous, which is far from being the case; on the contrary, it does not require any great force to compress the hardest materials used in building—a slight tap will make a sound stone ring like a bell, and when vibration occurs, it is certain that there is an alternate compression and dilatation of the particles acted upon; a carriage passing over an arch will set it in motion, which must necessarily cause the full momentum of one part of it to act against its opposite part, and that to react in its turn, not through *imaginary* points or lines, but through the *natural* masses. M. Garidel's method, applied to determine the horizontal stress of a platband, will give less than half of that determined by the other. According to his tables, an arch with level roadway of 60 feet span, 18 inches thick, and the whole depth at the vertex 7 feet 6 inches, will have the point of fracture at 54·04 degrees, and the horizontal thrust proportional to 900 × ·21702 = 195·858 feet, which does not differ much from the ratio of the stress determined above for an arch of the same span 3 feet thick, with the loading rather greater.

If R be 60 feet, and the vertical dimensions be as before—

30 : 60 :: 1 : 2. 30² : 60² :: 1 : 4.
S = 201·375 × 4 = 805·4.
C = 67·125 × 4 = 268·5.

If the span of a semi-elliptical bridge be the same as that of a semi-circular one, and the corresponding vertical dimensions have the same ratio, S is always the same, and the columnal measures are inversely as the depths of the keys. J. P. W.

NOTES IN THE PROVINCES.

THE two new ordnance stores in Portsea are to be built close to the ramparts, and an artesian well is to be sunk in one of them. The buildings, it is said, will be commenced immediately.——The contribution of 200*l.*, by Miss Littlehales, for a stained-glass window in St. Lawrence's Church, Winchester, has produced a strong inclination to realise, by rate, a further sum of 400*l.* to 500*l.*, in order to "befit the church for such a window."——The Bromsgrove vestry have under consideration plans and specifications, by Messrs. Rowlands and Day, of Worcester, architects, for the repairs of the church, at a cost of about 2,000*l.*——The first stone of the Southgate-street dock, at Gloucester basin, was laid on Tuesday week before last. The dock will be opened for business, it is thought, in March next.——The ancient houses in High-street, Old Cheltenham, opposite Cambray-place, supposed to have been in existence three centuries, have been levelled to the ground, to furnish a site for better buildings.——On Thursday week the gate of the new lock at Cumberland basin, Bristol, nearest the river, was hung. It is said to be quite a novelty. The span is 58 feet; depth, 29 feet; breadth at lower part, 12 feet, decreasing in a curved line to 3 feet. It is composed of many wrought iron plates, upon a frame of angle iron in three decks, forming water-tight compartments, and adding to its strength. The sluices are worked by right and left hand screws, and counterbalance each other. It opens as easily as an ordinary lock gate. There is a face of mahogany on the gate, which, when shut, bears upon a face of masonry, rendering the whole tight. The entire weight is about 95 tons. It was built at the Great Western Steam-ship works, under the superintendence of Mr. Jones.——The new entrance to Abergavenny is progressing; the foundation-stones of the bridge over the river Kenvy having been laid on Monday week. The contractor is Mr. Prosser. The new line of road from the bridge to its junction with Mill-street, forms an S curve. The works are superintended by Messrs. Sayce and Price, C.E., and will probably be completed by the end of the year.——A movement is to be commenced at Birmingham for the erection of model lodging-houses.——The Roman Catholic Church of St. Chad, in Bath-street, Birmingham, has been lately decorated under the superintendence of Mr. John Hardman, of that town, who, it is understood, has borne the whole expense. The roofs of the aisles are painted in a style corresponding to that of the nave; the decorations of the choir are specially noted. The screen and the rood have been cleaned, and the roof has been coloured. The beams springing from the arches are gilt, and the roof compartmented by gilded beams, each compartment coloured blue, and powdered with stars, with the emblem of the cherubim, set in a quatre-foil, in the centre of each. A double lancet decorated window has been introduced into the choir.——The vestry of St. Paul's, Bedford, have resolved to raise 1,500*l.* for repairs to the church generally, and particularly to the roof, which, according to the architects employed, Messrs. Wing and Jackson, stands much in need of it.——The first stone of the new church and school at Linslade, according to the *Northampton Herald*, was laid on Wednesday week.——The Romford vestry have resolved on erecting their proposed new church on the site of the present one, *alias* St. Edward's Chapel.——The new Corn Exchange at Lincoln, according to the local *Times*, is progressing rapidly towards completion. The clock turret is to cost about 1,000*l.*——The Victoria Promenade and Polytechnic Rooms, Bridlington Quay, have been thrown

open to the public. The suite of rooms consists of concert, promenade, polytechnic, news, and billiard rooms, and a tower, or observatory, in the castellated Gothic style. They have been erected by the Bridlington Quay Public Rooms Association, at an outlay of more than 7,000*l.* The site is at the north end of the stone pier and promenade. The architect was Mr. Worth, of Sheffield: Mr. Sissons, contractor, Wilson, stonemason, and Musgrave, bricklayer, all of Hull.——The lowest tender for the erection of the Hull baths and washhouses was that of Mr. Sissons. The Committee, however, says the *Hull Packet*, have adjourned their decision.——The new parish church of Aspatria was consecrated on Tuesday week. The rebuilding has been executed from designs by Messrs. Traviss and Mangnall, of Manchester, architects, at an estimated cost of 2,369*l.*, exclusive of extras. The foundations were laid on the site of the old building on 23rd July, 1846, and the style of the old edifice, the Early English, though on an enlarged scale, has been preserved. The material is the red freestone of the district. The length of the church, including the tower, is 118 feet 10 inches. The nave is 71 feet 10 inches by 40 feet; the chancel 30 feet by 15 feet 9 inches. The body of the church is divided into three aisles, the stone pillars which support the roof of the side aisles being all alternately circular, multangular, and of bold dimensions. There are stained-glass windows, executed by Mr. John Scott, of Carlisle. The roof is of open timber work, the pitch being an equilateral triangle. The seats are open and uniform; they will accommodate 600 persons. ——In draining on a farm of the Duke of Argyle's, at Inverary, a piece of masonic structure was lately found, enclosing a fountain of mineral water. The field had been known as the "Physic Well Park."——The Messrs. Gibson, of Saffron Walden, have now in the course of erection a Post Office, from designs by Mr. W. Beck; and the committee of shareholders for a new Corn Exchange, as designed by Mr. R. Tress, are about to commence the same. Mr. C. Erswell, builder, of Walden, is the successful competitor in both instances.

RAILWAY JOTTINGS.

THE quantity of food from agricultural and fishing or other shipping sources, poured into the metropolis weekly by railway, says the *Railway Times*, almost surpasses belief. The following quantities of provisions were forwarded *vid* Eastern Counties, during the week ending May 27th:—Beasts, 2,250; calves, 112; sheep, 7,980; pigs, 817; grain, 13,572; flour, 5,327 sacks; meat, 168 tons; poultry, 26 tons; fresh fish, 70 tons; fruit and vegetables, 198 tons; ale and porter, 207 tons; wool, 159 tons; wines and spirits, 78 tons; milk, 20,848 quarts; bread, 79 cwt., and general merchandise, 2,500 tons.—— The Admiralty agreed to a crossing of the Clyde by the Caledonian, and Glasgow, Paisley, and Ayrshire Railway Companies, on the conditions that the bridge should consist of only one pier, and 10,000*l.* instead of 8,000*l.* be paid to the Clyde trustees.——The New Holland station of the Manchester, Sheffield, and Lincoln line, on the Humber, opposite Hull, planned by Mr. J. Fowler, C.E., and executed by Mr. Court, is of brick with stone facings, with a pier of about 1,500 feet into the river, built of timber, 30 feet wide, and steps at different parts, for descent into the steamers, according to the state of the tide. Connected with the works, there is also a haven for coasting vessels, 600 feet long and 200 feet wide, with an entrance of 100 feet, and a length of frontage 624 feet. There are also gas works, engine and carriage buildings, &c. This station will be used in course of the autumn for the London traffic to Hull, Beverley, &c. Similar accommodation is wanted on the Hull side, where a floating 'tube' pier has been proposed.——About 60 yards of the sea-wall erecting on the sands near Llanelly, part of the works of the South Wales line, have been washed away by the tide.——The opening of the Fareham and Portsmouth branch of the South-Western is postponed, by the giving way of an arch by which it crosses over a lane, about a mile from Fareham.——Advices from New South Wales state, that the proposed line between Sydney and Goulburn had been surveyed, a length of 132 miles, and the cost of construction estimated at 2,100*l.* per mile.

METROPOLITAN COMMISSION OF SEWERS.

A GENERAL court was held on Thursday morning in last week, No. 13, House of Commons; the Right Hon. Lord Morpeth, M.P., in the chair. Mr. Hertslet read the communications of Mr. Harding, of No. 68, Long Acre, stating that, in spite of all remonstrances, his neighbour, Mr. Wicks, would continue to drain his premises into a most obnoxious cesspool, to the serious annoyance of himself (Mr. H.) and to the interruption of his business; and calling upon the court to put in force the powers of their new Act to compel him to drain into the sewer. The subject led to a good deal of conversation; and it was finally resolved that Mr. Wicks should be summoned to shew cause why he had not drained his premises into the sewer.

Lord Morpeth said he had received a letter from the Civil Surveyors' Association on the subject of the Ordnance survey of the metropolis, which he would now read to the court. The noble lord then read a letter, containing the grounds upon which the civil surveyors rest their application for employment, and to the chief of which we have previously referred.*

Lord Morpeth said, in reference to this subject, he could state for himself, as a member of the court, in this great measure of sanitary improvement, his wish was that it should be conducted in as efficient, economical, and rapid a manner as possible. As to the members of this body, he had no doubt that the men of science in the court had given their claims every consideration.

Mr. Chadwick rose for the purpose of moving that the resolutions passed at a former court in reference to the Ordnance survey, be also extended to the Holborn and Finsbury divisions. Mr. Chadwick then proceeded to combat the objections that had been urged by the civil engineers against the employment of the sappers and miners in the execution of the work. One ground was, that as it was a local work, and paid for out of the local rates, therefore it came within the province of the civil surveyors. According to this doctrine, which was taken on a ground that he had occasion to meet elsewhere, that because a man contributed one penny to the rates, he was entitled to a return of 1*l.*, or whatever price he set upon his own work and considered just. This was nothing less than the old doctrine of parochial political economy, that only the tradesmen of the parish were to be employed out of parochial rates, the soundness of which he had always been obliged to dispute. The associated civil surveyors next contended that it was "against all our national principles and practice to place a military body, raised, educated, and paid for military duties, in competition with any civilians in any profession or trade, to which these may have been educated at their own cost." But had the associated surveyors been educated for making surveys for sanitary purposes? He apprehended that when they were at school, employment for these special purposes could not have been contemplated by them. This he knew, that it was little more than five years ago that he was applied to by the late Professor of Geodesy at the College of Civil Engineers for suggestions as to conventional marks, and the special requirements of surveys for sanitary improvement, in order to have them inserted in an elementary treatise he was preparing; the ground for the application being that the work was so new and special, that it had not hitherto been taken into consideration. Of one member of the association, who appeared with the rest to claim the metropolitan survey as work for which they had been educated, he could say that not more than five years ago he (Mr. Chadwick) had exerted himself to procure work for him as a journeyman carpenter. He referred to the case without intending to disparage the individual, whose aim was meritorious. The question of public policy involved in giving an answer to the objection to the employment of the military on the survey, the question, namely, of the employment of the military in time of peace, was too large to be entered upon there, otherwise it might be shown that the employment of the Ordnance corps on beneficial public work was an example worthy of being considered with a view to its extension to the rest of the army. The example of the employment of this corps in beneficial public work, qualifying them for civil employment, was worthy of public note. Out of the associated surveyors, sixteen, or a minority, were known at the tythe-office as having executed first-class maps. The association offered a guarantee to do the work somewhat cheaper and quicker than it could be done by the Ordnance corps; and although their claims as rate-payers were not entertained, they were requested to furnish detailed evidence of their power to do what they had offered. After a very patient hearing, the committee were unanimously of opinion that the surveyors had failed to give that proof. The work they undertook was much less than that contained in the Ordnance survey; it was, moreover, to be sent in without verification, and the verification under the Ordnance system frequently occupied one-half of the whole time and labour. The committee fully and unanimously believed that they would lose time and money by interrupting the work under progress by the Ordnance and placing it in new hands. In respect to the difference between the Ordnance estimates and the eventual cost, it was fair to observe that as the work advanced, the public appreciation of its importance increased; and new particulars were added, until the survey at the conclusion was likely to be a widely different work from that originally contemplated. In respect to delay, he confessed he thought the northern towns had ground for complaint; but they might remember that the pace of the work was determined on before sanitary measures were in contemplation, and before there was any such pressing need. The committee had been at pains to strike out all non-essential particulars from their requirements. Those only of immediate urgency were included, and it was hoped that the Ordnance Board would direct their force now to step out at double-quick time, for, though the enemy was unseen and silent, their present service was against slaughter as great, ravages as dire, as of any enemy that they would ever be called upon to withstand in war. In conclusion, he trusted the court would confirm the resolutions, as to this district, they had already agreed to in the others, and moved their adoption.

Mr. Hutton seconded the motion.

Mr. Leslie said that the association had made a demand of the survey of the metropolis, but was there any security that its members might hang together a month, or even a week. It was true that they were told that the money was not to be paid until the court were satisfied that the work was well done, but in that case who were to be the umpires? Why, there would be no other course than to fall back upon the Board of Ordnance, who would be required to go over the whole of the work, which step must be attended with great expense, besides the difficulty of finding any person to whom the court should agree, and the association should agree, that the matter should be referred. By the plan adopted the greatest accuracy was ensured, and he hoped the work would not be taken out of the hands of the Board of Ordnance. In conclusion, Mr. Leslie adverted to a letter he had received from Mr. Keating, a civil engineer at Leeds (the letter was read), which declared the Ordnance an utterly incompetent body, whose blundering work was never finished, and whose estimate of 25,000*l.* would in the end at least be multiplied by three.

Lord Morpeth thought that it was desirable, as the work had been commenced by the Board of Ordnance, that the arrangement should not be disturbed. His lordship also said that it was out of no disrespect to the civil surveyors that the work had not been intrusted to them; at the same time he must observe that the works executed by the Board of Ordnance had been finished with an accuracy and precision that had excited universal approbation.

Mr. Chadwick also bore testimony to the ability of some of the members of the association, but there was no guarantee that all the members of that body were equally qualified.

The resolution was then put and carried unanimously.

A communication was read from the Ordnance

* We have received a letter in reply to our correspondent "W. C.," in our last number, for a part of which, in fairness, we must find space. He says:—As to expense, while the fact is uncontroverted that upon the area of Ireland, nearly twenty-two millions of acres, the cost was 10d. per acre (the highest charge made by private surveys), I think the less your correspondent alludes to economy the better, especially when it is considered that labour is cheap in that country, and that the survey of the northern province thereof is a most inferior work, being a naked town-land survey. I have, however, a fact to state that is not generally known, that at the commencement of the survey the military literally *botched* the triangulation of *eleven* counties, which had to be surveyed *de novo*, and every man who has practised in Ireland knows of the numerous errors everywhere to be found in this work of twenty years. Further, it has been altogether suppressed that this survey was not, and could not have been, made without the aid of six district *civil* engineers, under the control of Mr. Griffith, and these officers were severally aided by corps of young gentlemen, who prepared their work for the sappers, and left these worthies little to do but to chain; and I never heard that the cost of the civil department was included in the million paid for the Irish survey. The main question, however, at issue is the right of the Government to swamp a meritorious body of men throughout the United Kingdom by handing over their occupation to a body employed for very different purposes, and thus to take the bread out of the mouths of persons many of whom have spent much time and money in acquiring whatever knowledge they have. I say it is most unjust, and that the talk about economy, and the useful employment of the troops, is a pretence, and nothing more. The Surveyors' Association, to which I do not belong, merely indicates the feeling of the whole profession. They have been defeated for the present, but, at all events, let them persist in exposing the vicious system set up against them.—I am, &c. AN IRISH ENGINEER.

office, setting forth that the Master-General had given orders for the execution of the block plan of the metropolis, in conformity with the request of the Commissioners of Sewers.

The following recommendations of the General Purposes Committee were agreed to :—

That 520 feet of 12-inch sewer be built in Bowling-green Walk, Pitfield-street, estimated 130*l.*

That 7,800ft. of 3-ft. sewer be built from Lower-road, Islington, to Holloway, and that 2,830 feet thereof, estimated at 3,820*l.*, be commenced as soon as a contribution of 3,000*l.* promised by the Birmingham and Dock Railway Company, shall have been paid.

That 400 feet of 12-inch sewer be built in Laystall-street, estimated at 90*l.* conditionally.

Messrs. Acraman, Ashley, Campbell, and Lee, were summoned for irregular drainage in Vauxhall-walk, Lambeth. It appeared from a long discussion, that the surveyors of highways had for a long time past been in the habit of putting down large brick drains in this district, chiefly constructed without the use of mortar, and that the inhabitants had in many cases used them for all the purposes of sewers, thereby entirely superseding the functions of the commissioners.

Messrs. Acraman and Jermyns produced local acts, and contended that this court had no jurisdiction in the matter. This position was unanimously opposed by the commissioners, and it was finally determined that Mr. Acraman (surveyor of highways), should be fined 50*l.*, such fine not to be levied until after the next court, when, if the jurisdiction of the court was acknowledged, and a promise given not to resort to such practices in future, the fine would not be exacted. Mr. Acraman said he would lay the whole case before the Board.

A conditional fine of 10*l.* was also given against Mr. Gwynn, of the Walworth, for irregular drainage.

Miscellanea.

TUBULAR BRIDGES. — In consequence of certain claims made by Mr. R. Stephenson, in a letter to the *Manchester Guardian*, Mr. Fairbairn, "lamenting the necessity which existed for the friendly interference" of Mr. Bateman, says that, in justice to himself, he must "maintain that the working out of the idea, and the development of the principle, as well as the greater portion of the construction," are the results of his labours, "In corroboration of these facts," he adds, "I may further state, that *the original idea* [which he admits Mr. Stephenson to be entitled to claim], was a cylindrical tube, to be supported by chains, to which I was always opposed, and which, I think, can be proved would not have succeeded. In fact, it was only by a long series of inductive reasoning, founded upon experimental research, that the present strength and form of the Conway and Britannia tubes were established. That these researches are my own, and that the conclusions based upon them have been acted upon, cannot be denied; and I am satisfied that, if Mr. Stephenson would reconsider the matter, and allow his feelings fair play, he would admit the fact. The publication of the correspondence, should such a step be found necessary, will, however, prove the accuracy of these statements, whether admitted now or not."

WEAR OF LEAD.—Sir: Seeing in your valuable work, a notice of Professor Donaldson's remarks on lead, and lead-laying, I have enclosed a piece of lead, a fair sample of the state of a whole gutter, which has been laid but eleven months, between two copper flats in the neighbourhood of Belgrave-square. The flats are surrounded by a brick wall, which is compoed and coloured, and no water passes over the gutter from any other building. You will perceive the lead is destroyed in a similar manner to, and presents the appearance of, the bottom of a lead cistern which has not been cleaned for a long time. From a slight settlement of the roof, the gutter had not a proper current, and I find the lead most damaged where the water laid. Perhaps some of your scientific friends may think it worth noticing, and assign a cause for its destruction in so short a time, that the building-public may guard against a similar misfortune (it having caused a great portion of the roof, which is nearly new, to be disturbed).

JAMES JACKSON.

Broad-street, Golden-square.

*** The two metals, lead and copper, being in contact, would produce a galvanic action, which has doubtless assisted in the destruction of the lead.

PROJECTED WORKS.—Advertisements have been issued for tenders by 7th July, for rebuilding the chancel of Salwarpe Church; by 27th June, for repairing the spire of Hinckley Church; by 23rd, for repairing and repewing the parish church of East Norton, Leicestershire; by 26th, for the erection of a rectory-house at Hildersham; by 21st, for the building of St. Ann's Church Girls' Schools at Leeds; by 21st, for the erection of a school and master's house at Newmarket; by 23rd, for building a farm-house at Alstonby (Carlisle); by 24th, for repairing the Russell Institution, Great Coram-street; by 26th, for altering and enlarging the Long-Ashton Union Workhouse; by 29th, for erecting vagrant wards, fever wards, workshops, &c., at the Orsett Union Workhouse; by 21st, for the erection of fever wards at the Linton Union Workhouse; by 24th, for bricklayers', carpenters,' smiths', plumbers', and glaziers' works for one year in St. Marylebone (parishioners only as contractors); by 24th, for a supply of Guernsey, Groby, or Whitby chipping, &c., for St. Marylebone; by 3rd July, for a supply of 18,000 sleepers of larch, hacmatac, or yellow pine for the Shrewsbury and Wellington joint line of railway; by 5th July, for repairing and paving foot and carriage ways in Westminster; by 24th June, for a supply of flints, gravel, and hogging for the parish of St. Marylebone; and by 20th, for painting at the Billericay Union Workhouse.

EMIGRATION.—The *Port Philip Herald* gives the following scale of wages now obtainable in New South Wales :—"Mechanics—watchmakers, 2*l.* 10s. per week; beam-men, 2*l.* 10s.; carpenters and joiners, 6s. and 7s. per day; bricklayers, 7s. and 8s.; stonemasons, 7s. and 8s.; stonecutters, 7s. and 8s.; plasterers, 6s. and 7s.; bricklayers' labourers, 5s.; blacksmiths, 7s. and 8s.; painters and glaziers, 6s. and 7s.; cabinet-makers, 6s. and 7s.; sawyers, 2*l.* 2s. per week. With regard to the expense of the necessaries—Bread, the 4 lbs. loaf, 7d.; beef, 2d. per lb.; mutton, 2d. per lb.; tea, 1s. 8d. per lb.; and sugar, 3d. per lb. Single men could obtain board and lodging at 10s. per week." Lieut. Waghorn, who has done so much to promote internal communication, has just now published a letter to Earl Grey, wherein, in his energetic and enthusiastic manner, he asks Parliament to vote twenty millions to promote emigration, especially from Ireland, to Australia, where labour is much wanted. All classes of men are beginning to look to emigration on a large scale as a step that should be warmly promoted.

THE TIMBER TRADE.—Messrs. Chaloner and Fleming, of Liverpool, in their monthly circular, dated 31st May, observe, that as to the effect of the alteration of the timber duties, in that locality at least, the consumption of *both* of the staple articles of consumption, namely, colonial and Baltic fir, in the log, has been very largely increased, whilst a most astonishing impulse has been given to the production of the colonial spruce deal, by which the Baltic deals have been in a great degree superseded. The natural effect of stimulated production, they remark, has been an accumulated stock abroad, by which prices have been reduced, and this country is now about to reap the full advantage contemplated by the originators of the measure for the abolition of the duties on colonial wood; the pressure under which the timber trade is suffering being clearly traceable to the general depression of trade consequent on last year's monetary derangements. Before the alteration was mooted, Quebec yellow pine was sold at 15d. per foot, when Baltic ruled at 2s. 2d. per foot. At present the latest sales have been at 13½d. to 14d. per foot for the former, and 16d. to 18d. for the latter. The prospect of demand and importation this year, however, is not encouraging. The business in mahogany during the month has been considerable, but at declining prices, shewing that the general depression has at length reached this branch of trade. Honduras averaged 3d. 15 32 per foot; the larger wood 5½d. per foot. A new import from the Spanish Main, of 39 logs, was sold at 4½d. per foot.

THE COMPRESSED-AIR LOCOMOTIVE.—It is long since the idea was first entertained that atmospheric air, compressed, might be made to act on a locomotive like the wound-up main-spring of a watch; but the same tendency of the power to vary in intensity required some analogous means of regulation, and the want of these means has hitherto constituted an insurmountable obstacle to the practical adoption of this portable and safe, as well as powerful, agency. The Baron von Rathen, however, who has been long and arduously engaged, like another Boreas, in bottling up the winds for future use, has at length succeeded, it is *said*, in overcoming the great obstacles to the management of air compressed,—amongst which obstacles must also be enumerated the heat liberated in compression and absorbed in re-expansion. For the withdrawal of the first, he has invented an apparatus for cooling the compressed air; and for the restoration of the last, an apparatus for exposing it, while expanding, in thin films, to the natural heat of the atmosphere. The inventions, which are patented, also comprise a hydraulic pump for compressing the air, with pistons so acting in mutual relationship as to be continually in a different elevation of the stroke, and thus to obviate the inequality and loss of power in compression. Means for the regulation of the degree of working pressure have been also provided; and a locomotive for common roads, on these principles, is being built at the College of Civil Engineers, Putney.

FRENCH SCENERY AT DRURY LANE.—We went to Drury-lane Theatre on Monday night, for the purpose of seeing and speaking of the scenery, painted by French artists, which, as we understood, had been brought there. A vulgar, senseless, and most illiberal uproar, discreditable in the highest degree to the parties concerned, drove us out,—drove us out by the shame we felt in seeing a section of Englishmen so demean themselves. We must wait till they recover their senses.

PANCRAS WORKHOUSE COMPETITION.—A correspondent wants to know if "the committee of the St. Pancras Workhouse appointed to examine the designs for the workhouse, have yet completed their giant task? and, if so, whether they have committed the rejected designs to the purpose of lighting the office fire? or whether they are still accessible to their owners? as no report of them has yet appeared from the Secretary."

ROME AS IT IS.—On Thursday in last week Mr. Buckingham gave the last lecture, at the Western Literary Institution, of a course on Rome as it is, and brought the subject very forcibly before the minds of his auditors. He treated of things of which every one is supposed to know, but of which many are, in truth, quite ignorant, and gave some interesting particulars of St. Peter's, the Vatican, and the public fountains.

QUEEN'S COLLEGE, BIRMINGHAM.—Steps are being taken to secure to the inhabitants of the midland counties the advantages of a sound yet not expensive university education, with the degrees of bachelor of arts and master of arts, bachelor of civil laws and doctor of civil laws, at the University of London. A department of *civil engineering* will be formed, and the course of instruction will embrace all the principal subjects which are essential to the scientific engineer; and it will likewise be recommended that the students in this department should proceed to the degree of B.A.

THE BUILDERS' BENEVOLENT INSTITUTION.—We wish to direct our readers' attention to the anniversary dinner of this excellent charity, which is advertised to be held on the 19th, and to urge them to take that share in it which the importance of its object demands. We will seek an early opportunity to speak again of it, by which time we shall hope to see the list of stewards doubled at least.

TENDERS

For Sixteen Houses to be built for the Peckham Building Society (opened June 14th). Mr. G. Smith, Architect :—

Little and Son	£10,715
Burton	10,530
Holland	10,455
Curtis	10,298
I'Anson	10,110
Brown	9,967
Grimsdell	9,576
Wilson	8,990

MEETINGS OF SCIENTIFIC BODIES

Held during the ensuing week.

TUESDAY, June 20.—Institution of Civil Engineers, 8 P.M.

FRIDAY, 23.—Archæological Association, 8½ P.M.; Architectural Association.

TO CORRESPONDENTS.

"*B. B.*"—If the object of our perusal is simply to be that we may give an opinion, we have not time to do so.

"*Payment of Architects.*"—We hope to speak of this next week.

"*Liverpool Subscriber.*"—The arrangement of a room well fitted to transmit sound is too large a subject to treat summarily. There are papers on sound in former volumes of our journal, but we cannot at this moment refer to them.

"*Z. A.*" "*Amicus,*" "*One of a Society of Architects,*" "*Candidus,*" &c. &c. &c. &c. &c. Our ubiquitous correspondent can do his own work his own way: we beg leave to recommend him to allow us to do so likewise—*verb. sap.*

"*A. B.*"—There seems to be no reason why he may not put the original patentee's name on it; but it would be dishonest to make it appear that the article was *manufactured* by the patentee.

"*A. P.*"—The "Cyclopædia of the Buildings' Act," published at the office of THE BUILDER, will answer his purpose.

"*Subscriber.*"—We do not know an edition which contains the additional Acts. They can be had separately at the Queen's printers.

"*M. Charles V.*"—We shall be happy to comply.

"*Cracks in Oak.*"—A correspondent asks, "what is the *best composition* for stopping sun cracks in oak? The object is to obtain an endurable composition, as the oak has to be exposed to all weathers, and is *not* to be painted."

"*Lover of Justice.*"—The course proposed would not be detrimental to the character of the architect, but, if known, as of course it should be, would prevent other respectable architects from competing.

Received.—"H. W.," "R. W. A." (thanks), "H. E. D." "Propugnatur," "G. B. C.," "R. M. P." (shall appear), "B. W.," "J. C." (we have returned the drawings), "R. B.," "C. C." "The High-Pressure Steam-Engine," by Dr. Ernst Alban, Parts III. and IV. (John Weale, Holborn); "Electrical Condition applied to Facts," by Franklin Coxworthy (Peirce, 310, Strand).

ADVERTISEMENTS.

TO ARCHITECTS AND ENGINEERS.

THE Advertiser is desirous of meeting Gentlemen who require coloured Architectural Designs. Perspectives got up and coloured in the neatest style for competitions, at moderate terms. The Advertiser further begs to state that he makes a consideration in his charges, should the competition prove unsuccessful.

N.B. Tracings of the external line of the plan and elevation are all required by the Advertiser in executing the Designs he may be favoured with.—Address Mr. EDWARDS, 16, Woodstock-street, Bond-street.

By Her Majesty's Royal Letters Patent.

GLASS VENTILATORS FOR WINDOWS.

BAILLIE'S Patent Transparent Slide Valve VENTILATORS, supplied at a reduction of 40 per cent. from the original Tariff. Their extensive and successful application to public offices, bed-rooms, and the cure of smokey chimneys, prove their great utility. Coloured Glass of every tint at wholesale prices.—Designs and estimates for church and ornamental windows forwarded on application to EDWARD BAILLIE, Glass Painter, Stainer, and Embosser, 12a, Cumberland Market, Regent's-park, London, where specimens are to be seen.

DR. ARNOTT'S CHIMNEY VENTILATOR.

F. EDWARDS, Stove Maker to her Majesty, 20, Poland-street, Oxford-street, begs to call the attention of Architects, Builders, Gas-fitters and the Public, to the truly invaluable advantages to be derived from the use of Dr. Arnott's Valve for the Ventilation of Rooms of every description.

Prices from 7s. 6d. to 20s. each. A prospectus, containing full particulars, to be had on application.

SMOKY CHIMNEYS—NO CURE, NO PAY.

Twenty-five years' extensive experience in all the branches of a stove manufacturing business, and the cure of smoky chimneys of every description, fully justifies F. E. in stating that he can undertake the cure of smoky chimneys on the above equitable terms.

VENTILATION.—FAIRS' PATENT TRANSPARENT VENTILATORS.—The progressive increase in the use of this invention during several years' trial, in which it has had to contend with many imitations, encourages the Proprietors to recommend it with confidence to the Public generally, and to the Building Trade in particular, to whom they are now enabled to offer greater inducements for its adoption. For the CURE of SMOKY CHIMNEYS, and the thorough, but safe and agreeable, Ventilation of Apartments, Offices, &c., this invention is unequalled; and its general adoption in the Royal Palaces, the Public Offices, Banking-houses, Insurance Offices, and in the dining-rooms and other apartments in the houses of the nobility and gentry, are sufficient evidence of its efficacy.

Orders received by FAIRS and Co., No. 139, New Bond-street; BUNNETT and CORFE, No. 28, Lombard-street; and at the Manufactory, 15, Gillingham-street, Pimlico.

N.B. Ornamental Zinc Sashes and Casements for Gothic Windows, Stained Glass, &c.

CHAS. WM. WATERLOW,

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of Sashes and Frames, and Joiner to the Trade, 121, Bunhill-row, Finsbury-square.—Well-seasoned materials, superior workmanship, lowest prices.—Upwards of 400 DOORS, and a large variety of Sashes and Frames, always on sale. Glazed goods securely packed for the country. Steam-struck Mouldings in any quantity.—N.B. This Establishment is worth the notice of all engaged in building.

GREAT REDUCTION IN THE PRICE OF PLATE-GLASS.

THE UNION PLATE-GLASS COMPANY.—Pocket-nook, St. Helen's; 99, Hatton-garden, London; No. 13, York-street, Mosley-street, Manchester; and 28, North John-street, Liverpool; inform Builders and the public generally, that they are now selling ordinary glazing sizes of plate glass from 2s. to 3s. per foot, and smaller plates suitable for cottages, greenhouses, and conservatories, at 6d. to 1s. per foot.—RICHARD YATES, Secretary.

UNION PLATE-GLASS COMPANY.—Architects, Builders and the Trade generally are solicited to inspect the quality, colour and substance manufactured by this Company. To encourage the use of Plate Glass for glazing, a further reduction in price has taken place on the quality used for the purpose.

ROUGH PLATE GLASS supplied ¼, 3-8, ½, and ¾ inch thick. Particular attention is requested to the superior colour and evenness of this article.

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H. CHRISTIE, Agent.

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WINDOW GLASS.—THOMAS MILLINGTON begs to inform the Trade and Consumers that he has a large Stock of Sheet-Glass on hand, which he will supply in 200-feet cases, delivered free in London for 42s. 6d. per case, or cut to size, 3d. per foot.—Address, 87, Bishopsgate-street-without.

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THOS. MILLINGTON, 87, Bishopsgate-street Without, London, begs to inform the Trade, and consumers generally, that he is supplying the above articles of the best materials and upon the lowest terms for cash.

CROWN, SHEET, and PLATE GLASS, in any quantity; VARNISH: fine Oak or Wainscot, 10s; Carriage, 12s per gallon; White Lead, 27s., and Colours and Brushes; Water Closets complete, 30s.; Lifting Pumps and Cocks of every description.

Milk Pans; Propagating, Bee, and Cucumber Glasses; Paperhangings from 1s per piece upwards, of very superior description.

ARCHITECTURAL CARVING COMPANY, Eccleston-place (late Sir F. CHANTREY'S Foundry), Pimlico, respectfully direct the attention of Architects, Builders, and others to the facility afforded by their Machinery for carrying out with dispatch and accuracy, and at a great saving in expense, the most elaborate Designs in Wood or Stone.—Specimens may be seen and Estimates obtained on application at the Premises.

PAVING, 2s. 9d. PER SQUARE YARD, Basements, Foot-walks, Malt-houses, Corn Stores, Floors of Warehouses, and every description of Pavement laid down at the above low price, and the work guaranteed.—Apply to JOHN PILKINGTON, POLONCEAU'S BITUMEN PAVEMENT OFFICE, 15, WHARF-ROAD, CITY-ROAD.—N.B. Country Agents and Railway Engineers and Contractors supplied with the best bitumen for covering bridges and arches.

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ON SALE, a Quantity of SLATE SLAB. Parties wanting the articles (apply immediately) would be liberally dealt with, as the present Stock is to be cleared off previous to new arrangements.—Apply to Mr. THOMAS ELLIS, Union Slate Wharf, Wapping; HUGHES, STEELE, and Co., Halkin Wharf; and Messrs. JONES, Bangor Wharf, Pimlico.
June 14, 1848.

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P. FOUCARD, quai des Abattoirs Caen (propriétaire de Carrières à Allemagne), begs leave to inform Builders, Architects, and others, that he has, on the above-mentioned wharf, 50,000 feet of the best stone ready to meet the demands of purchasers.—Contracts taken for any quantities.

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WELSH SLATE SLABS of the Finest Description, and planed both faces, supplied to the Trade at the same prices that rough (self-faced) Slabs are being sold at the principal Slate Wharfs in town. A large discount is also allowed, or, in lieu of discount, parties ordering 150 feet and upwards may, if they prefer it, have the Slabs delivered, carriage free, to any canal or railway point within fifty miles of London.

N.B. Whole cargoes direct from the Quarries. Enamelled Slate Chimney-pieces, Slabs, Mural Tablets, Baths, Fonts, &c. &c.

Address, Mr. MAGNUS, Pimlico Slate Works, Upper Belgrave-place.

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The Trade will find a great advantage from this Establishment equal to the cost of the labour, as Vein Marble Chimney-pieces are sold at the small charge of 30s. each, which will enable the Mason to realise a great Profit: also a liberal Commission to Persons acting as Agents, for Monuments and large Chimney-pieces.—Direct, Westminster Marble Company, Earl-street, Holywell-street, Millbank, London.

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Stone-box Chimney-pieces, from	12s.
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Mr. GRISSELL has the honour to inform Architects and gentlemen engaged in Building, that in consequence of having nearly completed the above works, he is at liberty to supply the Anstone Stone for building purposes in general.

The price at which it can be delivered in London does not exceed the price of Portland stone. As to quality and colour, the experience of the past seven years will fully attest its superiority.

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ALFRED ROSLING begs to inform the Trade and Consumers generally, that he keeps constantly in stock a large and very general assortment of Prepared Floor Boards and Matched Boarding, planed to a parallel breadth and thickness, and fit for immediate use; also a variety of machine-prepared Mouldings, which are finished with great accuracy and attention to quality of workmanship.—Southwark Bridge Wharf, Bankside, and Old Barge Wharf, Upper Ground-street, Blackfriars.

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N.B.—T. A. has several Lots of Dry Cut Stuff to sell at reduced prices for cash, previous to stock-taking at Midsummer.

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TIMBER of any size, PLANK, DEALS, and BATTENS, &c., Sawn on the most approved principle. Boards, &c., Prepared, Matched, and Grooved, by Muir's Patent Machinery. The Mills have all the advantages of navigation and water-carriage, being connected with the Thames by the Grosvenor Canal. Goods fetched from the docks and carted home free of charge.

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WOOD THOROUGHLY SEASONED in DAYS instead of YEARS, by DAVISON and SYMINGTON'S PATENTED PROCESS, at the Patent Desiccating Company's Establishment (for Seasoning, Sawing, and Planing Wood), at the Grand Surrey Mills, immediately adjoining the Commercial and East Country Docks, Rotherhithe. The new process ensures the entire removal of moisture, hardens the gums, prevents further shrinkage, and strengthens the fibre.—For scale of prices, or license to work the patent, or any further information, address, post-paid, or apply to W. H. TANQUERAY, Secretary.

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Continued Rails, fixed complete, and French polished, with square Wood Ballisters and Iron Newil—

One story, per house	£2	15	0
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Within ten miles of London no extra charge if capped.

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CAST-IRON PIPES, IRON WORK FOR OVENS, &c.

RAIN PIPES, &c.—F. A. TIDDEMAN, Purfleet Wharf, Earl-street, City, near Blackfriars-bridge, keeps a large stock of Rain Pipes, Heads, Shoes, Elbows, &c., half round and O. G. Gutters, Socket Pipes for Water or Gas, Flanch Pipes, Sash Weights, and other Castings; Iron Work for Baker's Ovens of every description, fitted complete, to be had in sets or in parts.—Prices equal to all competition. Contracts taken to any extent.

TO GAS COMPANIES, Gas Fitters, and Gas Consumers.—N. DEFRIES, 10, Hampstead-road, 67, St. Martin's-lane, and 118, Argyle-street, Glasgow, having proved by eight years' experience his DRY METER, to be unrivalled, begs to say, that nearly 20,000 are now in use, defying injurious Gas, and are never affected by Heat, Damp, or Frost. They may be obtained on Hire of all the Gas Companies who supply Meters to their Customers.—Testimonials of great value may be obtained at either Factory.

J. MEACOCK, GAS FITTER, LANTERN MAKER, and METER MANUFACTURER, No. 7, Snow-hill, London, late of No. 71, Snow-hill, begs respectfully to inform Carpenters and Builders, and the Public in general, that in consequence of his increasing business, he has been induced to take the above extensive premises, and having purchased Machinery at considerable cost for the manufacture of Metal Sash Bars and Stall Board Plates, is enabled to offer them a considerable reduction of the present prices.—Estimates given to any amount for the above, in Town and Country.

IRON FOUNDRY, 9, Brick-lane, Old- street, St. Luke's.—J. J. JONES having made great additions to his STOCK OF PATTERNS, begs to inform the Trade, that he can now supply them with Plain and Ornamental Iron Columns, Girders, Railings, Gates, Iron Coping, Balconies, Window Guards, Verandahs, Ornamental Staircase Panels, Iron Staircases, Tomb Enclosures, Trellis Panelling, Lamp and other Brackets, Cantilevers, Newel Bars, Water Closet Work, Area Gratings, Fly and other Wheels, Wheel Plates, &c.
BAKER'S OVEN WORK, Forge Backs and Troughs, Rain Water Pipes and Gutters, Sash Weights, Furnace Bars, Stoves, Ranges, &c., always in stock.

IRON FOUNDRY,
168, DRURY-LANE, and CHARLES-STREET, DRURY-LANE.
JOSEPH GLOVER,
Solicits the attention of the Trade to his extensive Stock of PATTERNS for CASTINGS of EVERY DESCRIPTION, consisting of those for every purpose, either structural or ornamental.
Wheel Pinion and Steam-Engine Patterns; Range Stove and Hot Plate Metal.
A stock of Rain-Water Pipes, Plain and O G Guttering, Air Bricks, Sash Weights, &c. &c.
A very superior description of Soot Door, particularly suitable for internal work, being perfectly secure, and not unsightly.
ESTIMATES given for IRON ROOFING and every description of Ironwork, complete to specification, and the work executed with every attention to quality and dispatch.
GLOVER'S FOUNDRY,
168, DRURY-LANE, and CHARLES-STREET.

J. and J. HARTILL'S STOVE, FENDER, FIRE-IRON, and GENERAL FURNISHING IRONMONGERY WAREHOUSE, 89, WEST SMITHFIELD.
Register Stoves, 6d. per inch.
Elliptic Stoves, 2½d. per inch.
Cottage Range, with Oven and Boiler, 3 ft., 35s.
Self-acting Range, with Oven and Boiler, bright fittings, 3 ft. 6 in., 3l. 10s.
Drawing-Room Fenders 14s. each, usually sold at 1l. 1s.
All Goods Warranted.
J. and J. Hartill are Ironfounders. Fender and Fire-iron Manufacturers at Dudley. Established 1825.

TO ARCHITECTS, BUILDERS, &c.

R. HENLY and Co., WHOLESALE IRONMONGERS, and Manufacturers of KITCHEN-RANGES, STOVES, &c., 196, Blackfriars-road, and 117, Union-street, Borough.
Strong Self-acting Kitchen Ranges, with Back Boiler and Oven, and Wrought Bars:—

3 ft.	3 ft. 3 in.	3 ft. 6 in.	3 ft. 9 in.	4 ft.
£3. 6s.	£3. 13s.	£3. 16s.	£4.	£4. 10s.

Henly's Patent Improved, with back Boiler and Wrought Iron Oven:—

3 ft.	3 ft. 3 in.	3 ft. 6 in.	3 ft. 9 in.	4 ft.
£5.	£5. 15s.	£6. 5s.	£6. 10s.	£7.

Best Register Stoves, at 7d., 8d., and 9d. per inch.
Do. Elliptic do., 3d., 3½d., and 4d. do.
Manufacturer of WOLFASTON'S PATENT REGISTER STOVES, a certain cure for SMOKY CHIMNEYS, and effecting a great saving in fuel. To be seen in use daily.
Orders from the Country, accompanied with a remittance or reference, will meet with prompt attention.

TO BUILDERS and CARPENTERS.— Elliptic Stoves, double backs, 3d. per inch. Registers, 6½d., 7d., 8d. per inch.
Cottage Ranges, with Oven and Back Boiler, 3 ft., 33s.; 3 ft. 2 42s.; 3 ft. 4, 44s.; 3 ft. 6, 46s.
Self-acting Ranges, with Circular Oven and Back Boiler, best Wrought Bars and Bright Fittings,
3 ft., £3. 3s. 3 ft. 6, £3. 12s. 6d. 4 ft., £4.
Best Patent Cut Clasp.

5d.	6d.	8d.	11d.	1s. 4d.	1s. 10d. per 1,000.
3d.	4d.	6d.	8d.	10d.	20d.

Best Sheet Floor Brads 14s. per cwt.
Best Town Glue 38s. Do. Scotch, 52s. per cwt.
Best Patent Sash Line.

4s. 3d.	5s.	6s. 6d.	7s. 9d.	10s.	12s. per gross.
1	2	3	4	5	6

At F. R. WILLIAMSON'S IRONMONGERY and STOVE WAREHOUSE, 35, Chiswell-street, Finsbury-square.
Lists of Prices had on application at the Warehouse, or by letter pre paid, inclosing postage stamp.
N.B Warehouse closes at Seven o'clock.

WARMING by means of the circulation of WARM AIR.—BURRIDGE and HEALY beg respectfully to inform the public, that they are prepared to undertake the warming of churches, hot houses, &c. with a new apparatus of the most simple and durable construction, which they can warrant to keep in order any length of time, and which is capable of effectually warming buildings of any magnitude in a most economical manner.—BURRIDGE and HEALY, 130, Fleet-street.

HOT-WATER APPARATUS.—The attention of architects, builders, and others is respectfully requested to BENJAMIN FOWLER'S superior method of heating churches and chapels, halls, staircases, conservatories, forcing and greenhouses, manufactories and warehouses, kilns, rooms for drying timber, &c., and every variety of purpose for which artificial heat is required. Within the last twenty years some hundreds of buildings have been heated upon this plan, and the parties for whom they were executed are constantly expressing their satisfaction, also their willingness to vouch for their efficiency. An improved wrought-iron boiler, which requires no brickwork, may be seen in action upon the premises.—BENJAMIN FOWLER, 60, Dorset-street, Fleet-street.

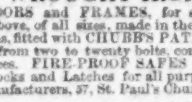
TO ARCHITECTS, BUILDERS, &c.

COPPER-WIRE CORD.—R. S. NEWALL and Co.'s PATENT IMPROVED COPPER-WIRE CORD for WINDOW SASH LINES, Hot-houses, Lightning Conductors, Hanging Pictures, Clock Cord, and various other purposes for which hempen rope has hitherto been used. This new and valuable Patent is fast superseding the use of the hempen cord, and is strongly recommended to all builders and other parties connected with the above. The Wire Cord may be had wholesale, and specimens seen at the office of the Patentees, No. 163, Fenchurch-street, W. T. ALLEN, Agent; or retail of G. and J. DEANE, 46, King William-street; E. PARKS, 149, Fleet-street; T. JONES, 63, Charing Cross, and GIBBONS and CO., 345, Oxford-street; also of all respectable Ironmongers.

LAP WELDED IRON TUBES.—W. H. RICHARDSON, Jun., and Co., MANUFACTURERS of every description of WROUGHT IRON TUBES for Locomotive and Marine Boilers, Gas, Steam, and other purposes.
PATENT TUBE WORKS, DARLASTON, STAFFORDSHIRE.

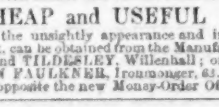
TO ARCHITECTS AND BUILDERS.

CHUBB'S WROUGHT-IRON and FIRE- PROOF DOORS and FRAMES, for strong Rooms. A large stock of the above, of all sizes, made in the best manner, and of different strengths, fitted with CHUBB'S PATENT DETECTOR LOCKS, throwing from two to twenty bolts, constantly on sale, at very moderate prices. FIRE-PROOF SAFES of every size, and Patent Detector Locks and Latches for all purposes.—C. CHUBB and SON, sole Manufacturers, 57, St. Paul's Churchyard, London.

By Her Majesty's  Royal Letters Patent.

BAILLIE'S PATENT ROUNDED RIM LOCKS,
WITH SECRET AND SECURE FIXINGS.

THIS CHEAP and USEFUL ARTICLE obviating the unsightly appearance and insecurity of the common rim lock, can be obtained from the Manufacturers, Messrs. CARPENTER and TILDESLEY, Willenhall; or from the sole Agent, Mr. JOHN FAULKNER, Ironmonger, 63, St. Martin's-le-Grand, London, opposite the new Money-Order Office.



T. PUGH'S REGISTERED RIM LOCK. —T. PUGH and Co. beg to invite the attention of Architects, Builders, and others, to these new Rim, Drawback, and Dead Locks and Latches, in either brass or iron, possessing great advantages in form, over the usual Rim Lock, and also in the quality, and produced at very moderate prices; each lock is warranted perfect and complete, with patent shifting spindles.—To be had only of T. PUGH and Co., 13, King-street, Snow-hill, City, at their Ironmongery Warehouse, where they keep an extensive and most complete stock of hammered and cut nails, iron and brass foundry, mortice locks and latches, plain, half-rabbeted, and rabbeted; porcelain, glass, ivory, buffalo horn, wood, and all kinds of fancy mortice lock furniture; all goods of the best manufacture, and of the same superior quality they have been accustomed to send out for upwards of the last twenty years.

FIRE BRICKS.—WARD and HART, Hondurus Wharf, Bankside, Manufacturers and Exporters of every sort of Fire Bricks, Lumps, Tiles, Clay, &c. Builders, Gas Companies, Engineers, Shippers, and all large buyers, supplied from the manufactories direct, at the lowest prices. A large stock of every quality always on hand at the wharf as above. Goods made to pattern at a short notice. Patent corn-drying malting tiles. Lime, sand, gravel, bricks and tiles of every description; Dutch clinkers, house sand (red and white), moulding ditto, &c. &c. Fire Bricks continually unloading in the river, and a considerable saving to purchasers wanting large quantities taking them from the ships.

WORCESTER ENCAUSTIC TILE WORKS.—The Proprietors, who are retiring from Business, are enabled to offer their STOCK of TILES at a very Reduced Rate. Ornamental Pavements of the best description, at 1s. 2d. per square foot; "Seconds," at 9½d.—N.B. These Tiles being manufactured in exact imitation of the best ancient specimens, are more suitable for the restoration of ancient Churches and Buildings than any others of modern make; and the present opportunity affords Architects and others the means of adopting a very beautiful decoration at the ordinary cost of stone. Arrangements have been made for any future "matchings" that may be required.—Specimens may be seen in London, at Messrs. GREIVE and GRELLIER'S Marble Wharf, Belvidere-road, Waterloo-bridge; and in the country, at the Works, Palace-row, Worcester.

TO BRICK AND TILE MAKERS.

THE AINSLIE BRICK and TILE MACHINE COMPANY (James Smith, Esq., of Deanston, Chairman) invite attention to their improved Brick and Tile Machines, which are to be seen at work at Alperton, and at the Company's office, 139a, Piccadilly, from Ten a.m. to Five p.m. Mr. Robert Scrivener, who has been appointed manager in the room of Mr. John Ainslie, will show the machines at the works at Alperton, which is within a mile of the Sudbury station of the London and North-Western Railway, and two miles of the Ealing station of the Great Western Railway; also at the Polytechnic Institution, Regent-street, London.—All communications to be addressed to Mr. WILLIAM GORDON, Secretary, at the office of the Company, London, 139a, Piccadilly.—March 1, 1847. These machines may also be seen at Mr. Slight's, Leith-walk, Edinburgh; Mr. Robert Boyle's, Ayr; Mr. Lawrence Hills, 125, Buchanan-street, Glasgow; Mr. Robert Charles', Mill-hill, Leeds; Messrs. Penny and Finch's Penkridge, Staffordshire; Messrs. Drummond and Son's, Dublin; and Mr. John Connor, Newton Lindvady, County Derry.

EMBOSSED FLEUR (REGISTERED).

ILLUSTRATED TRADE LISTS GRATIS, containing much information useful for reference, also Testimonials respecting a MATERIAL which, when well wrought is probably superior to every other for drains or conduits, for ridges, hips, valleys, and every part of roofs, for plain or chequered paving, for erecting sea-walls and other strong works, &c. To be had GENUINE of THOMAS PEAKE (proprietor of "Peake's Terro-Metallic"), No. 4 Wharf, City-road Basin, London; also, at the Tileries, Tunstall, Staffordshire. Articles would be supplied to any extent, and dispatched to any part of the world. The lists contain prices by measure as well as by number. Letters to be prepaid, and to say if the London or Staffordshire prices are wanted.

ZINC! ZINC! ZINC!

TO BUILDERS and the Trade generally.

2-inch pipe, 4d. per foot run, including fixing.			
2½	ditto	4½d.	ditto ditto.
3	ditto	5d.	ditto ditto.
3-inch eaves gutter,		3½d.	ditto ditto.
4	ditto	4½d.	ditto ditto.
4½	ditto	5d.	ditto ditto.

Flats covered and Cisterns lined from 4d. to 6d. per foot. Super Cornice Gutters, 5d. to 8d.—Pipe and Gutter forwarded to any part of the country.—Messrs. F. and J. HARLAND, 3, Cumberland-place, Newington, opposite the Fishmongers' Almshouses.

ARCHITECTURAL ENRICHMENTS.

BIELEFELD'S IMPROVED PAPIER MACHE, which has been almost universally adopted for architectural decoration, has been patronised by her Majesty, by the Honourable Commissioners of Board of Works, by the highest of the nobility and gentry, and by the most eminent architects of the day. It has been used at the royal palaces, at the present House of Lords, at Dublin Castle, at Drayton Manor, the new Conservative Club House, Grocers' Hall, &c., also at the British Museum and Pantheon Bazaar, where it has been extensively used for some years, and an inspection will sufficiently establish its superiority over every other kind of composition, both for beauty and durability. Designs prepared for the decoration of ceilings, panelling of walls, &c. A volume of enrichments, containing more than 1,000 designs of the papier mâché ornaments, with a tariff, price £1.—Works, 15, Wellington Street North, Strand.

TO THE BUILDING PUBLIC.

FIRST-RATE ORNAMENTS in ROMAN and other CEMENTS, and PLASTER of PARIS, at reasonable prices, consisting of Vases, Balusters, Capitals, perforated Panellings, Cantilevers, Brackets, Trusses, Wreaths, Scrolls Masques, Heads, Figures, Friezes, Gothic and other Chimney-Shafts, Soffits, Bed-mouldg, Pateras, &c., &c., 36-inch Centre, Flowers fixed complete, 24s. each, smaller in proportion. An assortment of Shop-front Trusses always ready for fixing.—JOHN HERBERT and SON, Modellers, &c., 42, Parker-street, Drury-lane.

ATKINSON'S CEMENT.—WILLIAM WOOD, Jun., Manufacturer of Roman, Portland, and Bath Cement, Blue Lias Lime Works, CHURCH STREET, ROTHERHITHE, Sole Consignee for Atkinson's Cement.—Grey Stone Lime Depôt. Cement Chimney-pots of every pattern.

KEENE'S PATENT MARBLE CEMENT forms an exceedingly hard and indestructible Stucco, which may either be prepared for paint, or finished in imitation of stone, by the addition of Portland or other stone dust.
It is a cheap and efficient substitute in place of wood for skirting, architrave, and other mouldings, in its application for which purposes it checks the progress of Fire and the attacks of Vermin.
Patentees and sole Manufacturers, J. B. WHITE and SONS, Millbank-street, Westminster, and Seel-street, Liverpool.

PORTLAND CEMENT.—Testimonials received from all quarters prove this CEMENT to possess the rare property of withstanding the severest frost, and to be consequently superior to every other for hydraulic purposes—such as the Building and Lining of Reservoirs, Cisterns, Baths, Fishponds, &c. For External Plastering and Ornamental Castings, it requires neither Colour nor Paint; it never vegetates, and will carry from three to four times its own body of sand.
Manufacturers, J. B. WHITE and SONS, Millbank-street, Westminster.

PORTLAND CEMENT, solely Manufac- tured by W. ASPDIN, Son of the Patentee. This Cement has been proved, for upwards of twenty years in the Thames Tunnel, to resist the action of water; it is stronger in its cementitious qualities, harder, and more durable than any other description of Cement; it does not vegetate, oxydate, or turn green; nor is it affected by any atmospheric influence whatever, the climate resisting alike the action of frost and heat. It is manufactured to set in from five to sixty minutes. For all purposes that Cement is applicable the Proprietors challenge competition.—Orders received by Messrs. ROBINS, ASPDIN, and Company, at their Manufactory, Northfleet, Kent, and their Wharf, Great Scotland-yard, Whitehall.

REMOVED FROM 5, MAIDEN-LANE, TO 22, STEEL-YARD, UPPER THAMES-STREET
TO ARCHITECTS, ENGINEERS, BUILDERS, Masons, Plasterers, and Painters, Merchants, Shippers, and the Public in general.

JOHNS and CO.'S PATENT STUCCO CEMENT, for outside Plastering—perfectly resembles Stone—utterly resists Wet—does not discolour by Damp—wants no Paint—never cracks or blisters—adheres to any substance without previous preparation—is not affected by Frost or Heat—may be exported to every Climate—it improves by Age—it is the only Cement that is a prompt and perfect remedy for internal Damp Walls—it is very cheap, and very easily worked.
Where also may be obtained,
JOHNS and CO.'S PATENT STONE COLOUR STUCCO PAINT, expressly for Painting over Exteriors of Houses that have been covered with Roman or other Cements, and which have become discoloured. This PAINT having an affinity for Stucco, binds itself with it, stopping the suction, thereby rendering the Wall proof against Weather, and in the finish producing a pure stone-like effect, producible by no other Paint whatever. It is cheap, and may be used by any Painter in any climate, even in the most exposed marine situations.—Specimens may be seen, and a Prospectus fully describing the Cement and its mode of application, may be had of Johns and Co., at 22, Steel-yard; or the Manufactory, Plymouth.

MARTIN'S FIRE-PROOF AND ORNAMENTAL CEMENT.

CAUTION.—Messrs. STEVENS and SON Patentees, beg to caution their friends and the trade generally against confounding this invaluable Cement with others, erroneously said to be of the same description. S. and S. pledge themselves that MARTIN'S CEMENT is totally dissimilar in composition and manufacture from every other, and being a neutral compound, is not only free from chemical agency upon any substance with which it may come in contact, but completely resists the action of the strongest acids. They feel it a duty to direct attention to the following properties, which it exclusively possesses:—
1. It rapidly acquires the hardness of stone.
2. Unlike other internal cements, its hardness is uniform throughout its entire thickness.
3. Its surface (which may be made equal to that of the finest marble) NEVER THROWS OUT ANY SALT, and will receive paint in four days, without pecling, when put upon dry work.
It is peculiarly adapted as an internal stucco for walls, skirtings, architraves, mouldings, and enrichments of all kinds, to all of which purposes it has been extensively applied by Mr. Thomas Cubitt, on the Grosvenor estate, &c.
For the above purposes, it possesses great advantages over woods, being more economical and durable, resisting fire, damp, and vermin.
For the floors of halls and fire-proof warehouses, its lightness, durability, and uniform surface give it an immense advantage over stone, being, at the same time, much more economical. The most satisfactory references can be given. To be had of the Patentees, Plaster of Paris and Cement Manufacturers, 18S, DRURY LANE.
Agent for Liverpool and Manchester, Mr. R. PART, 28, Canning-place, Liverpool.

PROTOXIDE PAINT, for Stucco Fronts, for Iron, Brickwork, and Wood. Manufactured only by CHARLES FRANCIS and SONS, Cement Works, Nine Elms.

EMERSON'S PATENT CEMENT PAINT. —This VALUABLE AND ECONOMIC PAINT is ready for use, is simple in its application, and only ONE-SIXTH the cost of oil paint; for beauty it is pre-eminent over all other materials used on the fronts of houses, giving the exact appearance of PINE CUT PORTLAND OR OTHER STONE; it can be used at once on fresh Roman cement or other plastering, and is particularly calculated for country houses, villas, or gate entrances that have become soiled or dingy, which can be at once beautified in any weather, at a mere trifling cost.—Sold in casks of 1 and 2 cwt., at 8s. and 15s. each.
PATENT MINERAL PAINT.
A brilliant black paint, invaluable as a coating for SHIP'S SIDES AND BOTTOMS; also for all kinds of WOOD or METAL work, or the asphalte roofing felts, leaky roofs, spouts, and gutters, doors, sheds, railing, and all kinds of out-door work, and being perfectly waterproof, will preserve their surfaces from atmospheric influence and decay.—requires no preparation, and will dry in a few hours.—Price 2s. per gallon.
PATENT ASPHALTE ROOFING AND SHEATHING FELT.
A large supply of the best quality, direct from the Manufactory, at low prices, for home use and exportation.
GEORGE LEAR and Co., Sole Agents for the Patentees, No. 5, Church-court, Clement's-lane, Lombard-street.